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# ENERGY

A CONTINUING BIBLIOGRAPHY  
WITH INDEXES

NOVEMBER 1974

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## ACCESSION NUMBER RANGES

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IAA (A-10000 Series)                      A 74-19206—A 74-28535

STAR (N-10000 Series)                      N74-15700—N74-21629

Previous publications announced in this series/subject category include:

Energy: A Special Bibliography NASA SP-7042  
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Energy: A Continuing Bibliography NASA SP-7043(01)  
(Coverage: Jan. 1, 1974 through Mar. 31, 1974)

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## ERRATA

for

ENERGY - A Continuing Bibliography (Suppl. 01)  
NASA SP-7043 (01)  
May 1974

Please substitute these abstracts on page 24 of NASA SP-7043 (01) as indicated.

**N74-13759** Polytechnic Inst. of Brooklyn, N.Y.  
**THE SYNCHRONOUS EFD DEVICE** Ph.D. Thesis  
Frank Richard Honigsbaum 1973 110 p  
Avail: Univ. Microfilms Order No. 73-24769

A survey of the literature reveals that the major objection to the use of electrofluidynamic devices for direct energy conversion has been that of low output per stage. This objection does not apply to the synchronous EFD device, because it permits simple and effective multistaging. Since the synchronous EFD Device is a recent development, efforts directed toward: (1) describing the basic concept; (2) validating it experimentally; (3) assaying its potential; and (4) deriving a simple circuit model. All of these objectives were met. Dissert. Abstr.

(This abstract replaces N74-12759 on page 24)

**N74-13766#** Energy Research Corp., Bethel, Conn.  
**HYDROGEN GENERATOR Final Technical Report**  
Edward S. Tillman, Jr. Aug. 1973 66 p refs  
(Contract DAAK02-71-C-0397; DA Proj. 1G6-63702-DG-10)  
(AD-767402; ERC-0397F) Avail: NTIS CSCL 10/2

A compact hydrogen generator for small liquid hydrocarbon fueled fuel cells was designed, built and partially tested. The basic generator embodies the steam reforming of liquid fuels available to the military. Provisions have been made for sulfur removal and hydrogen purification can be achieved with a palladium-silver hydrogen separator. Extensive testing on the reforming unit was conducted and results reported. An electronic control system for startup and steady state operation was designed and built but was not fully integrated with the reformer. Emphasis throughout the study was placed on miniaturizing components. Author (GRA)

(This abstract replaces N74-12766 on page 24)

The index entries refer to the substitute abstracts (N74-13759 and N74-13766) instead of the originally printed abstracts (N74-12759 and N74-12766). Thus, no change in the indexes will be necessary.



# ENERGY

## A Continuing Bibliography

### With Indexes

### Supplement 02

A selection of annotated references to unclassified reports and journal articles that were introduced into the NASA scientific and technical information system and announced from April 1 through June 30, 1974 in:

- *Scientific and Technical Aerospace Reports (STAR)*
- *International Aerospace Abstracts (IAA).*



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NOVEMBER 1974

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# INTRODUCTION

This supplement to *Energy: A Continuing Bibliography with Indexes* (NASA SP-7043) lists 405 reports, journal articles, and other documents announced between April 1, 1974 and June 30, 1974 in *Scientific and Technical Aerospace Reports (STAR)*, or in *International Aerospace Abstracts (IAA)*. The first issue of this continuing bibliography was published in May 1974 and supplements are issued quarterly.

The coverage includes regional, national and international energy systems; research and development on fuels and other sources of energy; energy conversion, transport, transmission, distribution and storage, with special emphasis on use of hydrogen and of solar energy. Also included are methods of locating or using new energy resources. Of special interest is energy for heating, lighting, for powering aircraft, surface vehicles, or other machinery.

Each entry in the bibliography consists of a standard bibliographic citation accompanied in most cases by an abstract. The listing of the entries is arranged in two major sections, *IAA* Entries and *STAR* Entries in that order. The citation, and abstracts when available, are reproduced exactly as they appeared originally in *IAA* or *STAR* including the original accession numbers from the respective announcement journals. This procedure, which saves time and money accounts for the slight variation in citation appearances.

Five indexes-subject, personal author, corporate source, contract number, and report number are included. The indexes are of the cumulating type throughout the year, with the fourth quarterly publication containing abstracts for the fourth quarter and index references for the four quarterly publications.

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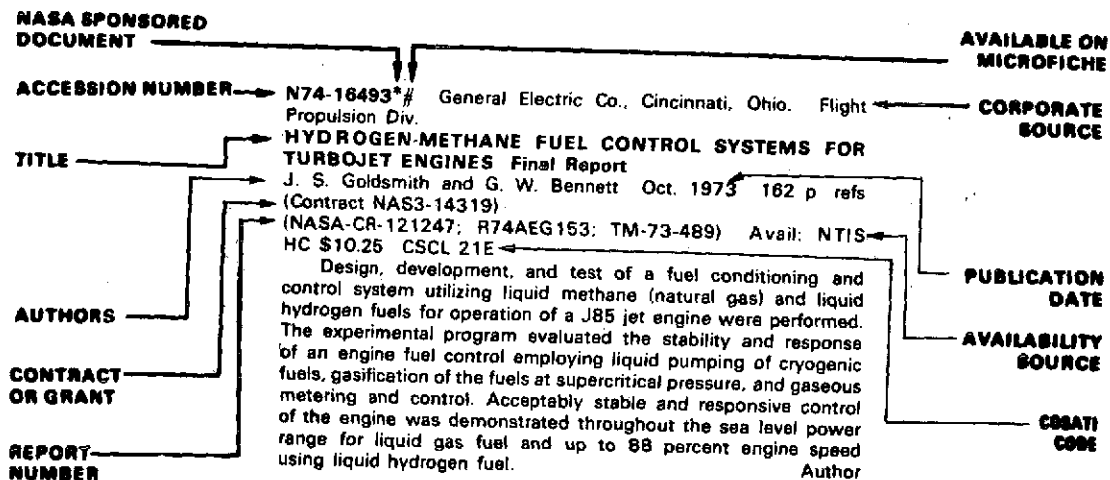
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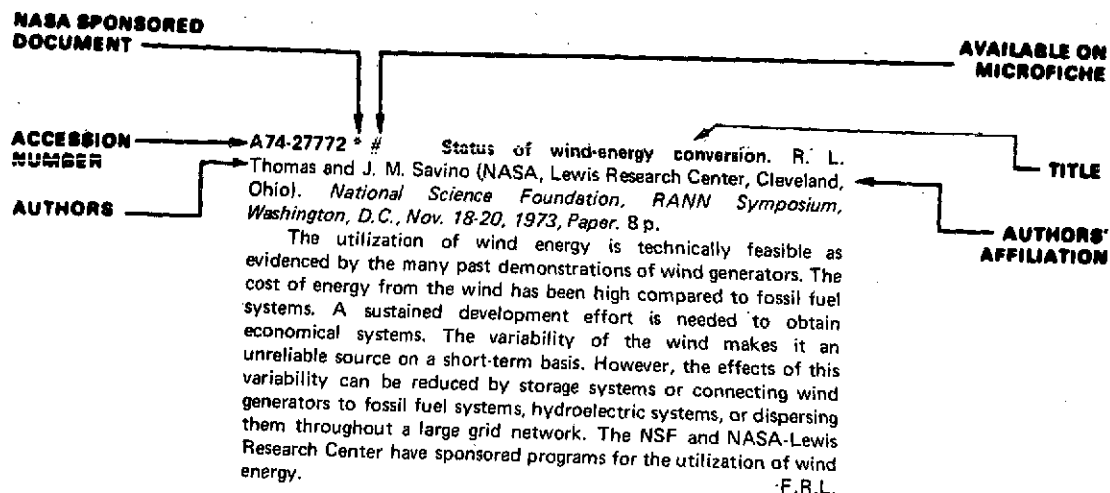
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## TYPICAL CITATION AND ABSTRACT FROM STAR



## TYPICAL CITATION AND ABSTRACT FROM IAA





## **A Listing of Energy Bibliographies Contained In This Publication:**

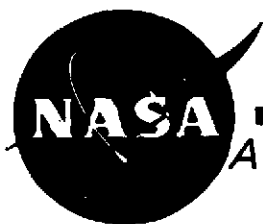
1. A Bibliography of Non-Technical Literature on Energy  
N74-16641 p0051

2. A Bibliography of Congressional Publications on Energy from the  
89th Congress to 1 July 1971  
N74-16642 p0051

3. Bearings for Power Station Plant. A Selective Bibliography, 1960 -  
September 1973  
N74-19113 p0073

4. Air Pollution Aspects of Emission Sources: Petroleum Refineries;  
A Bibliography with Abstracts  
N74-19228 p0073

5. Energy Sources - Citations from the Early DDC Collections  
N74-20705 p0081



# ENERGY

A Continuing Bibliography (Suppl. 02) NOVEMBER 1974

## IAA ENTRIES

**A74-19353 #** Hydrogen - Make-sense fuel for an American supersonic transport. W. J. D. Escher (Escher Technology Associates, St. Johns, Mich.) and G. D. Brewer (Lockheed-California Co., Burbank, Calif.). *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 12th, Washington, D.C., Jan. 30-Feb. 1, 1974, Paper 74-163.* 11 p. 21 refs. Members, \$1.50; nonmembers, \$2.00.

Arguments in favor of the use of liquid-hydrogen fuel for power supersonic transport aircraft are presented, with a view toward the 'better and faster' SST the U.S. will eventually build. It is seen that, in addition to the economic and operational advantages, the use of hydrogen will establish a sound basis for evolving out of the present self-limited petroleum era into tomorrow's hydrogen economy. V.P.

**A74-19454 #** Relaxation phenomena in an MHD generator with pre-ionizer. J. H. Blom. Eindhoven, Technische Hogeschool, Doctor in de Technische Wetenschappen Dissertation, 1973. 146 p. 59 refs.

A theoretical and experimental study was made of relaxation processes in MHD generators. From the calculations of the relaxation process in a two-dimensional geometry the configuration of pre-ionizers with respect to the maximum efficiency has been derived. The time-dependent behavior of discharges in preionizers and in a periodic generator segment have been studied using two-dimensional time-dependent calculations. A model for the calculation of the power output and efficiency of MHD generators has been developed. To study the relaxation processes in an MHD generator with an enthalpy input of 5 MW a shock tunnel was built which delivered a plasma with the desired parameters. The experimental results are explained by means of a theoretical analysis. The increase in the electron density due to preionization was in agreement with a quasi-one-dimensional theory. The experimental efficiencies for preionization ranged from 10 to 30%. Current distributions determined from measurements with electrostatic probes and high-speed photography showed a qualitative agreement with the theoretical results. F.R.L.

**A74-19455 #** Loss mechanisms in an MHD generator. J. W. M. A. Houben. Eindhoven, Technische Hogeschool, Doctor in de Technische Wetenschappen Dissertation, 1973. 164 p. 73 refs.

This doctoral thesis deals with loss mechanisms which reduce the efficiency and power output of nonequilibrium Faraday-type MHD generators. Particular attention is given to losses in the boundary region. The interaction of the losses is studied on the basis of an equivalent resistance model (whose development is described). Here, the losses are represented by resistances which are loads for the bulk of the MHD generator. Equations governing the processes responsible for the losses are derived and are used to calculate numerically the influence of the electrode configuration on generator performance. It is shown that rod electrodes placed in the flow perform better than flat electrodes at the wall. Experiments performed with cesium-seeded argon plasma are described, showing that voltage drops are by far the most dominant loss mechanism. The origin of the voltage drops is studied. V.P.

**A74-19473 #** The use of the pressurized balloon for detecting energy resources (L'impiego del pallone pressurizzato per il rilevamento delle risorse di energia). A. Castellani (CNR, Rome, Italy) and S. Vetralla (Centro Applicazioni Tecnologie Aerospaziali, Naples, Italy). *Istituto Internazionale delle Comunicazioni, Convegno Internazionale delle Comunicazioni, 21st, Genoa, Italy, Oct. 8-13, 1973, Paper.* 20 p. In Italian.

Discussion of the use of pressurized plastic balloons for the detection of energy resources. The balloon system to be employed is compared to aircraft, sounding rocket, and satellite systems. The remote sensors which could be used with a balloon system for earth resources surveys are described. The physics of pressurized balloons are analyzed to determine their performances. (Author)

**A74-19479 #** Energy problems in air transportation. G. E. Lundquist (FAA, Washington, D.C.). *Istituto Internazionale delle Comunicazioni, Convegno Internazionale delle Comunicazioni, 21st, Genoa, Italy, Oct. 8-13, 1973, Paper.* 26 p. 9 refs.

Energy development and usage are worldwide problems. The prospects of energy supply and demand over the long term indicate a critical impact on air transportation. Unless energy is conserved through various alternative actions, air transportation will suffer. This paper analyzes options for reducing demand, for improving efficiency, and for diversifying, both through alternative fuels and transportation modes, for the near term (one to 15 years) and the 15-year plus time frame. These options offer a 30 to 50% reduction in projected fuel requirements. (Author)

**A74-19481 #** Airports evolution and qualification (Evoluzione e qualificazione degli aeroporti). G. Pezzani. *Istituto Internazionale delle Comunicazioni, Convegno Internazionale delle Comunicazioni, 21st, Genoa, Italy, Oct. 8-13, 1973, Paper.* 27 p. 14 refs. In Italian.

The years 1950s and 1960s which mark the beginning of the air transportation industry, were decisive for airport structure through the realization of suitable flight and operational infrastructure capable of assuming practicability and receptivity. The 1970s with jumbo jets have new problems of dimensions and qualification for large airports together with problems of accessibility and ecology. Thus it is necessary to consider if the way followed until now, which leads to the superairport, does not have to be reexamined for a different solution to the problem of qualified airport systems. In the 1980s and thereafter, in addition to the use of atomic energy in air transportation, a new and unforeseeable leap will be made with mercantile aircraft. (Author)

**A74-19485 #** Prospects of energy conversion and storage derived from space systems technology. P. L. Bargellini (COMSAT Laboratories, Clarksburg, Md.). *Istituto Internazionale delle Comunicazioni, Convegno Internazionale delle Comunicazioni, 21st, Genoa, Italy, Oct. 8-13, 1973, Paper.* 36 p. 11 refs.

A review of the state of the art in the energy conversion field indicates that the photovoltaic converter is now the most common and efficient type of energy converter. It is anticipated that recent improvements in silicon solar cells will benefit the development of terrestrial solar power plant technology. Solar power plants in space are also considered as a possibility in the future. V.Z.

**A74-19486 #** The implications for air transportation of energy shortage. L. A. Mountford and R. E. Williams (Shell International Petroleum Co., Ltd., London, England). *Istituto Internazionale delle Comunicazioni, Convegno Internazionale delle Comunicazioni*, 21st, Genoa, Italy, Oct. 8-13, 1973, Paper. 25 p.

After referring to the enormous increase in air transport during the last twenty years, encouraged by the considerable availability of low cost fuel, the authors discuss the problems and difficulties which may in the near future affect the aviation market's oil supplies. The more demanding quality requirements and the ever growing needs of light distillates by all the other markets are taken into consideration. Attention is given, moreover, to the possibilities open to the oil companies, aircraft manufacturers, and airline operators in order to moderate and alleviate this critical situation. (Author)

**A74-19559** Characteristics and applications of the solar furnaces of the Central Laboratory of Armament (Caractéristiques et objectifs des fours solaires du Laboratoire Central de l'Armement). R.-M. Meunier (Délégation Ministérielle pour l'Armement, Laboratoire Central, Arcueil, Val-de-Marne, France). *Revue Internationale des Hautes Températures et des Réfractaires*, vol. 10, Oct.-Dec. 1973, p. 297-302. 5 refs. In French.

Two solar furnaces are described that have been designed and built for the purposes of testing materials for resistance against thermal shocks characterized by steep and sudden rises in surface temperature, and for studying the phenomena associated with such thermal shocks. The tests are applied, particularly, to materials liable by the nature of their service (e.g., protective shielding against the thermal effects of nuclear explosions, certain spacecraft or aircraft components) to be subjected to thermal shocks. The design and performance characteristics of these solar furnaces are reviewed, and they are shown to make possible the application of thermal shocks over wide ranges of several parameter values. M.V.E.

**A74-19690** Helicopter applications at sea (Les applications maritimes de l'hélicoptère). A. Renaud. (Association Technique Maritime et Aéronautique, Session, 73rd, Paris, France, May 14-18, 1973.) *Association Technique Maritime et Aéronautique, Bulletin*, no. 73, 1973, p. 621-632; Discussion, p. 633-638. In French.

Current and future applications of the helicopter at sea are reviewed for both military and commercial service tasks. Discussed missions include rescue, antisubmarine warfare, mine sweeping, the deposition of pilots on merchant ships at sea or of personnel and supplies on oil-drilling ocean platforms. Some of the navigation and safety problems involved are examined. M.V.E.

**A74-19724** Gas-heated 'heat pipe' vacuum furnace (Gasbeheizter 'Wärmeröhren'-Vakuumofen). M. Stadelmann (Fotos Hutchins Photography, Inc., Belmont, Mass.). *Schweizerische Technische Zeitschrift*, vol. 71, Jan. 17, 1974, p. 40-43. 5 refs. In German.

The heat pipe is a very efficient device for the transportation of heat at high temperatures on a thermoionic basis. One of the applications of the heat pipe is connected with the development of a vacuum furnace which utilizes natural gas for heating. In the new device the heat pipe is used for the transfer of heat from a high-temperature burner to a vacuum chamber. The vacuum furnace provides temperatures up to 1037.5 C at a vacuum of 5 microrr.

G.R.

**A74-19726** The fuel crisis and the controller. J. E. McNamara (Air Transport Association of America, Washington, D.C.). *Journal of Air Traffic Control*, vol. 16, Jan.-Feb. 1974, p. 5-9.

The effectiveness of the use of optimum flight profiles as a means of reducing the fuel crisis is studied on the basis of selected performance data for the B-727-200 series aircraft. It is shown that the success of airline fuel conservation programs will depend on the controller and the facility planner. A discussion of a method of measuring fuel savings shows that a descent profile must be applied to existing procedures to determine where these savings can be realized. V.P.

**A74-20067 #** Effect of dry friction on the response to a symmetric harmonic signal of an energy converter producing mechanical energy (Vlianie sukhogo treniia na otklik regulirnogo preobrazovatelya energii v mekhanicheskuiu, otrabatyvaiushchego simmetrichnyi garmonicheskii signal). V. N. Prokof'ev, I. Iu. E. Zakharov (Moskovskoe Vysshee Tekhnicheskoe Uchilishche, Moscow, USSR), and E. A. Musatov. *Mashinostroenie*, no. 12, 1973, p. 60-68. 10 refs. In Russian.

**A74-20166 #** The airship can meet the energy challenge. J. G. Vaeth (NOAA, National Environmental Satellite Service, Washington, D.C.). *Astronautics and Aeronautics*, vol. 12, Feb. 1974, p. 25-27.

It is suggested that lighter-than-air craft, in the form of very large airships, can be developed using nuclear propulsion. Such an airship can be designed to move cargo pieces weighing a million pounds and more into difficult-to-reach places at energy expenditures matching available resources. Inherent environmental cleanliness and quiet would be important fringe benefits. F.R.L.

**A74-20213** Clean, bright, and dry. J. C. Bradley (Gulf Research and Development Co., Pittsburgh, Pa.). In: *Manual on requirements, handling, and quality control of gas turbine fuel*. Philadelphia, Pa., American Society for Testing and Materials, 1973, p. 57-72.

It is the purpose of this paper to pinpoint some of the sources and types of fuel contamination and to outline precautions and procedures currently in use by the industry to preclude the possibility of contaminated fuel from reaching the turbine. In this connection, practices used in the aviation sector of the industry will be explored in detail since millions of gallons of jet fuel daily are being supplied to aviation turbines clean, bright, and dry with utmost reliability of product quality. Similar procedures applied to ground and marine units can assure dependable and economical operation. (Author)

**A74-20216** Purification of fuel oils by centrifugal force. F. H. Hilts (De Laval Separator Co., Poughkeepsie, N.Y.). In: *Manual on requirements, handling, and quality control of gas turbine fuel*. Philadelphia, Pa., American Society for Testing and Materials, 1973, p. 121-132. 5 refs.

Discussion of the means and merits of centrifugal purification of fuel oils, i.e., for the removal of water, solids, and other contaminants heavier than fuel oil. The optimal centrifuge types are defined depending on the oil to be purified, and the purifying performance is discussed in terms of processing cost efficiency. M.V.E.

**A74-20627** Power sources 4: Research and development in non-mechanical electrical power sources; Proceedings of the Eighth International Symposium, Brighton, Sussex, England, September 24-26, 1972. Symposium sponsored by the Joint Services Electrical Power Sources Committee of England. Edited by D. H. Collins. Newcastle-upon-Tyne, England, Oriel Press, Ltd., 1973. 606 p. \$24.60.

Topics discussed include a lithium/sulfur battery, a reversible negative electrode for alkaline storage batteries based on hydrides of the Ti-Ni system, high-discharge-rate long-life nickel/zinc cells, a bipolar NiO(OH)-K3BO3-Zn accumulator with a zinc ion repelling separator, separators for silver/zinc alkaline cells, the effect of KOH on sintered silver electrodes, a silver oxide/zinc battery, sintered-plate nickel hydroxide electrodes, a hot-pressing technique for fabricating cadmium and nickel electrodes, a laser interferometric method of measuring the current distribution at nickel and cadmium electrodes, the thermal behavior of sealed nickel/cadmium batteries, the nickel/cadmium cells used on the OAO spacecraft, a two-layer oxygen electrode with a hydrophilic porous nickel layer and a hydrophobic carbon layer, the electrochemical behavior of mixed

oxides in aqueous media, the use of charge-transfer complexes as electrodes in rechargeable batteries, and a rechargeable lithium nonaqueous battery which utilizes lamellar transition metal dichalcogenides as 'host' structures for cathodic nonmetals.

Individual items are announced in this issue.

A.B.K.

**A74-20628** A high rate primary lithium-sulphur battery. B. A. Askew and R. Holland (Admiralty Materials Laboratory, Poole, Dorset, England). In: Power sources 4: Research and development in non-mechanical electrical power sources; Proceedings of the Eighth International Symposium, Brighton, Sussex, England, September 24-26, 1972. Newcastle-upon-Tyne, England, Oriel Press, Ltd., 1973, p. 21-30; Discussion, p. 31. 7 refs.

A primary version of the lithium-sulfur cell has been developed in which the two parallel electrodes operate in close proximity in a sealed system. The cell uses a foam metal matrix for lithium retention and compressed graphite felt for the cathode current collector, separated by a thin layer of fused salt electrolyte. This three-liquid system was shown to be stable even when operated in a vertical plane. Cells with 8.3 sq cm electrodes have been discharged for periods of 20 min at a current density of 0.5A/sq cm at an average voltage of 1.8 V. A short-term power density capability of over 1.5 W/sq cm has been demonstrated. (Author)

**A74-20630** Sealed, rechargeable nickel-zinc cells. A. Charkey (Energy Research Corp., Bethel, Conn.). In: Power sources 4: Research and development in non-mechanical electrical power sources; Proceedings of the Eighth International Symposium, Brighton, Sussex, England, September 24-26, 1972. Newcastle-upon-Tyne, England, Oriel Press, Ltd., 1973, p. 93-101. Grant No. DAAB07-71-C-0134.

Progress report on the development of a new generation of sealed, rechargeable nickel-zinc cells consistent with long life operation and economic construction. The cells discussed have nonsintered type active nickel electrodes and inorganic separator systems. Cyclic performance data obtained show that these cells are at present capable of 300 cycles and could be improved to a typical performance of at least 400 cycles. Truly long-life nickel-zinc batteries capable of 1000 cycles appear to be a distinct possibility in the near future. M.V.E.

**A74-20631** Nickel-zinc cells with non-sintered electrodes. D. P. Boden and E. Pearlman (ESB, Inc., Yardley, Pa.). In: Power sources 4: Research and development in non-mechanical electrical power sources; Proceedings of the Eighth International Symposium, Brighton, Sussex, England, September 24-26, 1972. Newcastle-upon-Tyne, England, Oriel Press, Ltd., 1973, p. 103-112; Discussion, p. 112, 113. 9 refs.

Nickel-zinc cells have been fabricated from positive electrodes prepared by a unique, low-cost milling technique. These cells are capable of being discharged at the 4C rate with little capacity loss. At reduced temperatures no capacity loss is observed down to -18 C, while at -30 C approximately one-half of the room temperature capacity is obtained. One hundred and sixty full depth cycles have been obtained, provided that a simple conditioning procedure is applied periodically. (Author)

**A74-21028** Schottky-barrier solar-cell calculations. D. L. Pulfrey and R. F. McQuat (British Columbia University, Vancouver, Canada). *Applied Physics Letters*, vol. 24, Feb. 15, 1974, p. 167-169. 11 refs.

The maximum theoretical conversion efficiency of Schottky-barrier solar cells is calculated in order to ascertain their possible utility. It is shown that Schottky-barrier solar cells are theoretically capable of a maximum solar-energy conversion efficiency very similar

to that of conventional homojunction solar cells. Furthermore, the greater simplicity of fabrication of the former makes them an attractive consideration for use in both space and terrestrial environments. F.R.L.

**A74-21316** High energy radiography - A new technique in the development of efficiency and integrity in aero gas-turbine engines. D. A. W. Pullen (Atomic Energy Research Establishment, Nondestructive Testing Centre, Harwell, Berks., England). (*American Society for Nondestructive Testing, National Spring Conference, Los Angeles, Calif., Mar. 12-15, 1973.*) *Materials Evaluation*, vol. 32, Feb. 1974, p. 25-30, 37. 6 refs.

Discussion of the use of radiography for measuring seal clearances between rotating and static components and for determining the position and shape of various components in a full range of static and dynamic conditions in gas turbine engines. A linear accelerator with its great output of high energy X rays has for the first time made possible such applications of radiography. The various parameters are reviewed which must be adhered to in order to obtain optimal results. M.V.E.

**A74-21874** # The environment and the gas turbine. A. H. Lefebvre and R. S. Fletcher (Cranfield Institute of Technology, Cranfield, Beds., England). In: Symposium on the Environment and Transport Technology, Loughborough University of Technology, Loughborough, Leics., England, September 10-13, 1973, Proceedings. Volume 2. Loughborough, Leics., England, Loughborough University of Technology, 1973, p. D.17.1-D.17.25. 18 refs.

The major pollutants produced by gas turbines and the manner and extent to which their exhaust concentration varies with combustor design and engine operating conditions are discussed. Various techniques for reducing emission levels are described, including rich and lean primary zones, water injection, compressor air bleed, variable geometry, and staged combustion. It is suggested that the 1979 U.S. EPA emission standards for aircraft can be met by relatively straightforward modifications to the combustor combined with the use of compressor air bleed at idling. Reference is made to the contribution made toward easing the emissions problem by a reduction in engine specific fuel consumption. F.R.L.

**A74-22271** # Aviation turbine fuel and its lubricating qualities. II (Flugturbinenkraftstoff und seine Schmiereigenschaften. II). H. Ebert (Staatliche Luftfahrtinspektion, Berlin, East Germany). *Technisch-ökonomische Informationen der zivilen Luftfahrt*, vol. 9, no. 6, 1973, p. 322-324. In German.

Specifications for aviation turbine fuels prescribe a very low sulfur content because of highly unfavorable effects of sulfur admixtures on the nickel-containing structural materials employed in the aircraft propulsion systems. The available resources of mineral oil with the required low amounts of sulfur, however, are steadily decreasing. The aviation fuel needed must, therefore, be obtained by refining mineral oil which occurs naturally with higher sulfur contents. The refining process destroys unfortunately surface active substances which enhance the lubricating qualities of the oil. Approaches for overcoming these problems are considered. G.R.

**A74-22272** # The Dolphin airship with undulating propulsion system - A new form of the evaluation factor (Delphinluftschiff mit Wellantrieb - Neue Form der Wertigkeitszahl). W. Schmidt (KdF-Arbeitsausschuss zum Studium der Luftschiffahrt, Dresden, East Germany). *Technisch-ökonomische Informationen der zivilen Luftfahrt*, vol. 9, no. 6, 1973, p. 351-354. 7 refs. In German.

The airship evaluation factor due to Jaray and reported by Pfeiffer (1935) is considered. The evaluation factor is the ratio

between propulsion efficiency and air resistance coefficient. In the case of the Dolphin airship, the evaluation factor in its present form cannot be used due to the impossibility of a separate determination of the two parameters involved in the ratio. A new evaluation factor is, therefore, derived and used for the evaluation of a number of airships. G.R.

**A74-22279 #** The motion of a conducting piston in a channel with variable inductance (Dvizhenie provodiashchego porshnia v kanale s peremennoi induktivnost'iu). V. V. Poliudov, V. M. Titov, and G. A. Shvetsov. *PMTF - Zhurnal Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki*, Nov.-Dec. 1973, p. 41-46. 7 refs. In Russian.

Consideration of the motion of a conducting piston in a conduction-type MHD generator channel with solid electrodes. Formulas are obtained for calculating the power characteristics of a pulsed MHD generator under various operating conditions. It is shown that in an MHD generator at values of the magnetic Reynolds number much greater than 1 the power transferred to an ohmic load can substantially exceed the values obtained by Pain and Smy (1961) and Conger (1967). The conditions for obtaining a high coefficient of conversion of piston kinetic energy into electrical energy at a maximum value of the ratio of the electrical energy to the energy of the initial magnetic field in the generator channel are discussed.

A.B.K.

**A74-22355** Design of high-temperature solid-electrolyte fuel-cell batteries for maximum power output per unit volume. E. F. Sverdrup, C. J. Warde, and R. L. Eback (Westinghouse Research Laboratories, Pittsburgh, Pa.). *Energy Conversion*, vol. 13, Dec. 1973, p. 129-141. 11 refs. Research supported by the U.S. Department of the Interior and Westinghouse Electric Corp.

A high-temperature, solid-electrolyte battery design study is reported for an integrated fuel-cell power system that makes possible power densities exceeding 8 kW per cu ft of power-cell volume. The cost of the battery raw materials is expected to lie in the range of \$10-20 per kilowatt of generating capacity. An approximate treatment, and also a distributed-parameter treatment, are presented.

M.V.E.

**A74-23091 \*** Aircraft symmetric flight optimization. M. Falco (Grumman Aerospace Corp., Research Dept., Bethpage, N.Y.) and H. J. Kelley (Analytical Mechanics Associates, Inc., Jericho, N.Y.). In: Control and dynamic systems. New York, Academic Press, Inc., 1973, p. 89-129. 16 refs. Contracts No. AF 29(600)-2671; No. AF 49(638)-1207; No. NAS9-11532.

Review of the development of gradient techniques and their application to aircraft optimal performance computations in the vertical plane of flight. Results obtained using the method of gradients are presented for attitude- and throttle-control programs which extremize the fuel, range, and time performance indices subject to various trajectory and control constraints, including boundedness of engine throttle control. A penalty function treatment of state inequality constraints which generally appear in aircraft performance problems is outlined. Numerical results for maximum-range, minimum-fuel, and minimum-time climb paths for a hypothetical supersonic turbojet interceptor are presented and discussed. In addition, minimum-fuel climb paths subject to various levels of ground overpressure intensity constraint are indicated for a representative supersonic transport. A variant of the Gel'fand-Tsetlin 'method of ravines' is reviewed, and two possibilities for further development of continuous gradient processes are cited - namely, a projection version of conjugate gradients and a curvilinear search.

A.B.K.

**A74-23221 #** Effect of finite chemical reaction rates on heat transfer to the walls of combustion-driven supersonic MHD generator channels. J. W. Daily (Stanford University, Stanford, Calif.), J.

Raeder, and G. Zankl (Max-Planck-Institut für Plasmaphysik GmbH, Garching, West Germany). *AIAA Journal*, vol. 12, Mar. 1974, p. 403, 404. Contract No. F33615-72-C-1088.

**A74-23376** Fluid power for aircraft: Modern hydraulic technology /2nd edition/. S. W. Merrill (Utah State University of Agriculture and Applied Science, Logan, Utah). Preston, Idaho, Intermountain Air Press, 1973, 286 p. 14 refs. \$9.00.

This book summarizes in a simple descriptive form the state of the art in aircraft applications of advanced hydraulic technology. The principles of hydraulic power generation, accident prevention and maintenance techniques, housekeeping practices, fluid supply in hydraulic units, direction and volume control, and hydraulic fluids are discussed. Hydraulic units, maintenance tools, plumbing operations, pressure-limiting, regulating and unloading devices, braking and landing gear systems, hydraulic system actuation, emergency pneumatic systems, hydraulic testing, and support systems are described. Attention is given to the troubleshooting of a complete hydraulic system. A glossary of the terms used is appended. V.Z.

**A74-23464 #** Airline airplanes for the eighties - A response. J. Steiner (Boeing Commercial Airplane Co., Renton, Wash.). *Astronautics and Aeronautics*, vol. 12, Mar. 1974, p. 42-51.

Considerations of airline airplane selection for the 1980s are discussed in response to a recent British appraisal. It is pointed out that more system efficiency can be gained, and fuel saved, by solving the scheduled-vs-charter situation than by any other means, including airplane and engine design. The total commercial passenger-airplane market is expected to continue to require large, medium, and small aircraft in both short- and long-range applications. M.V.E.

**A74-23839 #** Lockheed S-3A Viking - With low fuel consumption over a wide power range the TF34-GE2 has high thrust to weight. *Aircraft Engineering*, vol. 46, Feb. 1974, p. 18-21.

**A74-23842 #** Photo-electric generators. W. Palz (Centre National d'Etudes Spatiales, Paris, France). *Industries Atomiques et Spatiales*, vol. 18, Jan.-Feb. 1974, p. 21-25.

This is an introductory article covering the field of solar photoelectric generators. A description is first given of the various semiconductor materials which can be used in the manufacture of solar batteries. It is then given some insight into the technology currently used in the making and the installing of solar batteries. And finally a summary is given of the principal fields of application of the photoelectric converters. It is to be borne in mind that space vehicles are almost exclusively powered by solar photoelectric generators. On the other hand, earthside uses are in an incipient stage of development. In the context of today's international energy crisis, it can be predicted that they will have a brilliant future. (Author)

**A74-24054** Cost efficient tungsten carbide-carbon fuel cells (Zur wirtschaftlichen Anwendbarkeit von Wolframcarbid/Kohle-Brennstoffzellen). H. Zühl, H. Böhm, and F. A. Pohl. *Wissenschaftliche Berichte AEG-Telefunken*, vol. 46, no. 3-4, 1973, p. 109-116. In German. Research supported by the Bundesministerium für Forschung und Technologie.

It is shown that the WC-C fuel cell offers for many applications an excellent alternative to conventional power sources. For illustration, three demonstration examples are presented: (1) electric trucks for industrial warehouse and plant applications; (2) fork lift trucks; and (3) power supply for radio link stations. M.V.E.

**A74-24313 #** Onboard energy sources and propulsion systems for balloons (Sources d'énergie de bord et systèmes propulsifs pour ballons). P. Balaskovic (ONERA, Châtillon-sous-Bagneux, Hauts-de-Seine, France). (Association d'Etude et de Recherche sur les Aéronefs Allégés, Colloque, Paris, France, Nov. 12-14, 1973.) ONERA, TP no. 1311, 1973. 9 p. 6 refs. In French.

The significant characteristics and merits of the various energy sources and propulsion systems are reviewed that present-day technology makes available for the propulsion of dirigibles or airships. It is shown that the highest cruising velocity achievable by modern means for a transatlantic airship of 1,000,000 cu m could hardly exceed the moderate figure of 215 km per hour. M.V.E.

**A74-24697** Astafan - A new concept from Turbomeca. N. Williams. *Shell Aviation News*, no. 421, 1974, p. 22-27.

Stemming from the basic design concept of the Turbomeca Astazou, the Astafan is a constant speed ducted fan engine. It is a marriage between the low bypass engine and the turboprop. In effect, the propeller was removed from an Astazou and a high bypass fan was fitted. The Astafan 111 has a bypass ratio of 8:1. The constant engine speed goes a long way toward preventing surge and flame extinction, and the airflow behind the fan is assisted by a double set of stator blades before reaching the main gas generator intake. Specific fuel consumption is only 0.385 lb/lb/hr, and takeoff thrust is 1740 lb, which with water injection increases to 1870 lb. The Astafan can make use of its reverse capability as an airbrake. Handling characteristics and procedures are discussed in detail.

F.R.L.

**A74-24901** Photovoltaic power and its applications in space and on earth; International Congress on the Sun in the Service of Man, Paris, France, July 2-6, 1973, Proceedings (L'énergie photovoltaïque et ses applications dans l'espace et sur terre; Congrès International sur le Soleil au Service de l'Homme, Paris, France, July 2-6, 1973, Compte Rendu). Congress sponsored by UNESCO. Brétigny-sur-Orge, Essonne, France, Centre National d'Etudes Spatiales, 1973. 662 p. In French and English. \$25.15.

Recent advances in silicon and Cu<sub>2</sub>S solar cells are reported in papers dealing with improved device fabrication processes, factors participating in degradation mechanisms, design details of spacecraft solar cell arrays, and prospects of economically justified terrestrial applications. Some particular topics include details of integrated solar cell panels, design features of flexible and deployable large arrays, fabrication methods for thin-film solar cell structures, and the performance of protective coating materials.

T.M.

**A74-24902** The ESTEC technology programme in solar energy conversion. K. K. Reinhartz (ESRO, European Space Research and Technology Centre, Noordwijk, Netherlands). In: Photovoltaic power and its applications in space and on earth; International Congress on the Sun in the Service of Man, Paris, France, July 2-6, 1973, Proceedings. Brétigny-sur-Orge, Essonne, France, Centre National d'Etudes Spatiales, 1973, p. 27-34. 14 refs.

Review of the current status and future prospects of a program of applied research on photovoltaic solar energy conversion sponsored by the European Space Research and Technology Center. The research carried out deals with solar cells (mainly silicon solar cells and only to a minor extent the Cu<sub>2</sub>S-CdS cell), silicon solar cell modules, including the use of welding for the interconnection of solar cells and the development of a process for the deposition of integral covers for solar cells by cathode sputtering of glass, and, finally, design studies of rigid and flexible deployable solar panels. A basic program of future applied research and technology in the field of photovoltaic energy conversion is outlined.

A.B.K.

**A74-24903** Solar cell development in the Federal Republic of Germany. H. R. Lösch (Gesellschaft für Weltraumforschung mbH, Porz-Wahn, West Germany). In: Photovoltaic power and its applications in space and on earth; International Congress on the Sun in the Service of Man, Paris, France, July 2-6, 1973, Proceedings.

Brétigny-sur-Orge, Essonne, France, Centre National d'Etudes Spatiales, 1973, p. 35-44. 11 refs.

Development work conducted with gallium arsenide was discontinued because the results made it appear that it would not be possible to meet the original design goal of a more economical and more reliable solar cell of lighter weight on a GaAs basis. It is pointed out, however, that GaAs cells might have possibilities for large power plants on earth. Work for the development of nuclear reactors was also terminated. The two reasons for this decision were the high development costs and new advances in enhancing the power of silicon cells. Since 1970 studies have been conducted to improve further solar cells by raising their efficiency, reducing cell thickness, and improving the radiation stability. Activities in the field of solar generators are also reported.

G.R.

**A74-24904** Results and future prospects on photovoltaic power development in France. W. Palz (Centre National d'Etudes Spatiales, Paris, France). In: Photovoltaic power and its applications in space and on earth; International Congress on the Sun in the Service of Man, Paris, France, July 2-6, 1973, Proceedings.

Brétigny-sur-Orge, Essonne, France, Centre National d'Etudes Spatiales, 1973, p. 45-52.

A flexible array with silicon cells has been built at SNIAS. It is a fold-up array with an end-of-life power of 1 kW. The actuator is a pantograph. In parallel, MATRA has developed an advanced rigid array. The comparison of both arrays shows that for typical missions such as telecommunications it would be preferable to use rigid arrays instead of flexible arrays as long as the mission power is to be lower than 1 kW. The main results and objectives of the CdS activity are presented. Tests on ground and in space have shown that the stability problems have been resolved. An analysis of the economic problems shows that the CdS cell is a promising device for terrestrial applications.

(Author)

**A74-24905** Analysis and improvement of silicon solar cells (Analyse et améliorations des cellules solaires au silicium). D. Amingual, C. Motte, T. Nguyen-Duy (Société Anonyme des Télécommunications, Paris, France), S. Mottet, A. Roizes, R. Schuttler (ONERA, Département d'Etudes et de Recherches en Technologie Spatiale, Toulouse, France), and W. Palz (Centre National d'Etudes Spatiales, Paris, France). In: Photovoltaic power and its applications in space and on earth; International Congress on the Sun in the Service of Man, Paris, France, July 2-6, 1973, Proceedings.

Brétigny-sur-Orge, Essonne, France, Centre National d'Etudes Spatiales, 1973, p. 61-77. 10 refs. In French.

Both theoretical considerations and recent experimental results have demonstrated possibilities of improving standard solar cell performance. The analysis of limiting factors has led us to define three directions of study: the N type layer, the basic material, and the rear electrode. The ion implanted-N-layer has allowed a better spectral response at short wavelengths. Otherwise, a double diffusion process has solved the problem of contacts on a thin N layer. An increase of both open circuit voltage and fill factor has been obtained by lowering the basic material resistivity. A gridded rear electrode results in a lower operating temperature and an enhancement of the spectral response at long wavelengths.

(Author)

**A74-24906** The optimization of silicon photocell operated in conjunction with solar radiation concentrators. V. M. Evdokimov and A. F. Milovanov. In: Photovoltaic power and its applications in space and on earth; International Congress on the Sun in the Service of Man, Paris, France, July 2-6, 1973, Proceedings.

Brétigny-sur-Orge, Essonne, France, Centre National d'Etudes Spatiales, 1973, p. 79-87.

A mathematical method is described for determining the

dependence of the efficiency of a silicon photocell on the doping level of the rear layer. Consideration is given to a cell with uniform exposure and to a cell illuminated perpendicularly to the p-n junction. For photocells with uniform exposure, the optimum doping level is found to increase as the light intensity increases. Intensity increase is accompanied by photocell heating with consequent rise of opposite saturation current and decrease of photovoltage. Therefore, the creation of a cooling system is seen as a means of obtaining greater efficiency. For photocells illuminated perpendicularly to the p-n junction, it is found necessary to reduce the front layer series resistance to obtain greater efficiency. P.T.H.

**A74-24908 Technology and performance characteristics of integral diode solar cells.** H. Fischer and W. Pschunder (Telefunken AG, Heilbronn, West Germany). In: Photovoltaic power and its applications in space and on earth; International Congress on the Sun in the Service of Man, Paris, France, July 2-6, 1973, Proceedings. Brétigny-sur-Orge, Essonne, France, Centre National d'Etudes Spatiales, 1973, p. 99-110, 6 refs. Research supported by the Gesellschaft für Weltraumforschung.

This paper summarizes the possible technical approaches for the realization of integrated diodes. Part of an experimental optimization program is presented which leads to the innovation of a Schottky-type integral diode. Path resistance of the lateral diode on the rear side of the solar cell body is minimized by the introduction of a multifinger geometry. The influence of photo- and transistor effect which occur at a diode-solar cell structure was analyzed. Electrical characteristics of various integral diodes are presented. (Author)

**A74-24909 Low-cost silicon solar cells for terrestrial applications.** P. H. Fang (Boston College, Chestnut Hill, Mass.). In: Photovoltaic power and its applications in space and on earth; International Congress on the Sun in the Service of Man, Paris, France, July 2-6, 1973, Proceedings. Brétigny-sur-Orge, Essonne, France, Centre National d'Etudes Spatiales, 1973, p. 111-115. NSF-supported research.

To realize a large-scale application of the photovoltaic generation of electricity as a terrestrial power source, a thin layer silicon solar cell structure is proposed. The silicon layer is grown on a stainless steel substrate with a titanium layer of about 1 micron in between to provide ohmic contact. The availability and the economy of stainless steel is recognized. The methods to grow the semiconductor silicon layer by evaporation, by chemical vapor deposition, and by sputtering are reported. (Author)

**A74-24910 New technology for CdS-Cu<sub>2</sub>S solar cells of high reliability.** J. Besson, J. Fremy, T. Nguyen-Duy, G. Pichard (Société Anonyme des Télécommunications, Paris, France), and W. Palz (Centre National d'Etudes Spatiales, Paris, France). In: Photovoltaic power and its applications in space and on earth; International Congress on the Sun in the Service of Man, Paris, France, July 2-6, 1973, Proceedings. Brétigny-sur-Orge, Essonne, France, Centre National d'Etudes Spatiales, 1973, p. 117-131, 7 refs.

Since the '9th Photovoltaic Specialists Conference', very important progress has been made. The final phenomena of electrochemical instabilities have been ruled out, even for cells being operated in open circuit conditions. The technology has been qualified by a combined test program in space and on ground. Moreover, the technology has been simplified; the collecting grid is now laid down by an electroplating process. Owing to these advancements, it has been considered that the starting of mass fabrication was justified. At this moment a 70 W generator for balloons is being completed. (Author)

**A74-24911 The present potential of CdS solar cells as a future contender for photovoltaic space and terrestrial power**

applications. R. J. Mytton (International Research and Development Co., Ltd., Newcastle-upon-Tyne, England). In: Photovoltaic power and its applications in space and on earth; International Congress on the Sun in the Service of Man, Paris, France, July 2-6, 1973, Proceedings. Brétigny-sur-Orge, Essonne, France, Centre National d'Etudes Spatiales, 1973, p. 133-150, 12 refs.

A brief assessment is given of the current position regarding the relative merits of CdS and silicon solar cells for both space and terrestrial applications. Having drawn attention to the present absence of any known major stability problem with CdS cells, two other important criteria are adopted for drawing a comparison between the two cells. The first of these is the expected cost in medium scale production of solar modules required for remote and portable terrestrial applications. Brief details are given of an integrated approach to the CdS module construction which uses current technology but results in significant cost savings. The other criterion is the power-to-weight ratio for space arrays. In both of these cases CdS cells are shown to possess significant potential advantages. (Author)

**A74-24912 Possibilities of the thin solar battery applications for the terrestrial use units.** I. V. Karpenko and R. N. Tykvenko (Ministry of Electrical Engineering Industry, Moscow, USSR). In: Photovoltaic power and its applications in space and on earth; International Congress on the Sun in the Service of Man, Paris, France, July 2-6, 1973, Proceedings. Brétigny-sur-Orge, Essonne, France, Centre National d'Etudes Spatiales, 1973, p. 151-157.

Thin film photoconverters on the basis of cadmium sulphide and telluride are considered. The photovoltaic effect is realized in Cu<sub>2</sub>S-CdS, Cu<sub>2</sub>S-CdTe, and Cu<sub>2</sub>-Te-Cd<sub>2</sub>Te heterojunctions where Cu<sub>2</sub>S or Cu<sub>2</sub>Te layers are produced by a chemical mode or by discrete spraying in vacuum. The base thin film photoelectric characteristics are given. Thin film module constructions in glass sealed tubes and the results of their tests under terrestrial conditions are considered. (Author)

**A74-24914 Partial results concerning CdS solar cells.** J. Bernard, S. Mottet (ONERA, Département d'Etudes et de Recherches en Technologie Spatiale, Toulouse, France), and J. Martin (Centre National d'Etudes Spatiales, Toulouse, France). In: Photovoltaic power and its applications in space and on earth; International Congress on the Sun in the Service of Man, Paris, France, July 2-6, 1973, Proceedings. Brétigny-sur-Orge, Essonne, France, Centre National d'Etudes Spatiales, 1973, p. 173-182.

For several years the CNES has developed thin-film solar cells using CdS as the basic material. This material possesses good photoelectric qualities and has the advantage of having physical properties in the form of thin polycrystalline films almost identical to the material mass. Efficiencies of 7 per cent are regularly obtained with solar cells covered with Aclar, and one has the right to ask if space or earth uses might be possible. In this paper, we make a synthesis of the main results we obtained during the last years in order to foresee the different uses of this new type of solar cells. (Author)

**A74-24915 Terrestrial utilization of CdS-Cu<sub>2</sub>S solar photocells in the south of France (Utilisation terrestre des photopiles solaires aux CdS-Cu<sub>2</sub>S dans le sud-est de la France).** S. Martinuzzi (Aix-Marseille, Université, Marseille, France). In: Photovoltaic power and its applications in space and on earth; International Congress on the Sun in the Service of Man, Paris, France, July 2-6, 1973, Proceedings. Brétigny-sur-Orge, Essonne, France, Centre National d'Etudes Spatiales, 1973, p. 183-188, 5 refs. In French.

The performance of photovoltaic conversion of solar energy by means of CdS-Cu<sub>2</sub>S thin films photocells is examined, in the French east south, for the 1980-1990 period. It seems that this production mode of electric energy could be competitive, around 1985, if the

conventional kWh price is three times increased because of the antipollution stresses and the increase of fuel price. (Author)

**A74-24918** On inhomogeneities of thin film solar cells. G. H. Hewig and P. Pfisterer (Stuttgart Universität, Stuttgart, West Germany). In: Photovoltaic power and its applications in space and on earth; International Congress on the Sun in the Service of Man, Paris, France, July 2-6, 1973, Proceedings. Brétigny-sur-Orge, Essonne, France, Centre National d'Etudes Spatiales, 1973, p. 207-216. 13 refs.

The local distribution of surface potential, photovoltaic efficiency, and temperature under forward and reverse current conditions of Cu(x)S-CdS thin film solar cells have been studied. The methods employed were a scanning electron beam, a scanning light beam, and a cholesteric liquid crystal. All cells investigated by the above methods show inhomogeneities in both local domains and larger areas. Special forms of degradation were investigated by a flying-spot tube, and the buildup of local defects can be proved. (Author)

**A74-24921** The RAE lightweight solar array. F. C. Treble (Royal Aircraft Establishment, Space Dept., Farnborough, Hants., England). In: Photovoltaic power and its applications in space and on earth; International Congress on the Sun in the Service of Man, Paris, France, July 2-6, 1973, Proceedings. Brétigny-sur-Orge, Essonne, France, Centre National d'Etudes Spatiales, 1973, p. 239-250.

This paper traces the development of the RAE lightweight flexible fold-up solar array, culminating in the recent successful tests on a 280 W prototype which have qualified the design for six years in geostationary orbit. The array embodies a number of unique features, including 125 micron silicon solar cells with wraparound contacts, 100 micron ceria-stabilized glass coverslips, cementless mounting of cells on the flexible substrate, and deployment by a pneumatically actuated telescopic mast. A small version of the array is to be flown on the British X4 satellite in 1974, and a 900 W derivative is planned for the Geostationary Technology Satellite. (Author)

**A74-24924** Optical coatings for semiconductor photovoltaic converters and solar energy concentrators. M. M. Koltun (Ministry of the Electrical Engineering Industry, Moscow, USSR). In: Photovoltaic power and its applications in space and on earth; International Congress on the Sun in the Service of Man, Paris, France, July 2-6, 1973, Proceedings. Brétigny-sur-Orge, Essonne, France, Centre National d'Etudes Spatiales, 1973, p. 273-282. 11 refs.

The results of investigations performed on the optical coating properties for solar energy semiconductor photoconverters and concentrators are given. It is shown that with the aid of optical coatings the problems of reduction of solar radiation reflection from the semiconductor surface, improvement of the heat balance, protection of the conductor photoconverter from space radiation, and protection of the solar energy concentrator from atmospheric effects can be solved. (Author)

**A74-24928** Current delivered by the solar array of the D2A-Tournesol satellite (Courant délivré par le générateur solaire du satellite D2A-Tournesol). M. Audibert (Centre National d'Etudes Spatiales, Paris, France). In: Photovoltaic power and its applications in space and on earth; International Congress on the Sun in the Service of Man, Paris, France, July 2-6, 1973, Proceedings. (A74-Brétigny-sur-Orge, Essonne, France, Centre National d'Etudes Spatiales, 1973, p. 327-350. 5 refs. In French.)

The current-voltage characteristics of the silicon solar cell array of D2A were measured under laboratory conditions of an air mass of

1, an illumination of 100 mW/sq cm, and a cell temperature of 28 C. It was calculated that the value of the current obtained (2.38 A) would have to be multiplied by a factor of 1.18 to obtain the value of the current that the solar array would have delivered under standard operating conditions of air mass zero, illumination equal to one solar constant, and cell temperature of 28 C. The current was then measured during the first orbit and was found to be 1.14 times the laboratory value. A different value for the solar constant would have obtained the correct correction factor. In the first ten months of orbit, the degradation of the array was found to be greater than predicted, but after the twelfth month the predicted and actual degradation were in close accord. Bombardment of the cells by low energy protons is discussed as a principal cause of degradation. P.T.H.

**A74-24929** Description and interpretation of the results observed concerning the technological solar cell satellite. J. Bernard, S. Mottet (ONERA, Département d'Etudes et de Recherches en Technologie Spatiale, Toulouse, France), and M. Le Metayer (Centre National d'Etudes Spatiales, Toulouse, France). In: Photovoltaic power and its applications in space and on earth; International Congress on the Sun in the Service of Man, Paris, France, July 2-6, 1973, Proceedings. Brétigny-sur-Orge, Essonne, France, Centre National d'Etudes Spatiales, 1973, p. 351-359. 8 refs.

Within the framework of the Franco-Soviet cooperation agreement, a technological satellite was launched in April 1972 with the aim of studying solar cells. Several experiments concerning new technological aspects of solar cells were undertaken to examine thin film CdTe solar cells, thin film CdS solar cells, and silicon solar cells (preirradiated and nonirradiated). The effects observed on silicon solar cells and on other thin-film solar cells made of CdS and CdTe are described. The observed short-circuit degradations are compared with those previously obtained under laboratory conditions. (Author)

**A74-24933** The solar generator of the telecommunication satellite *Symphonie*. W. Kirchhof (Centre National d'Etudes Spatiales, Brétigny-sur-Orge, Essonne, France). In: Photovoltaic power and its applications in space and on earth; International Congress on the Sun in the Service of Man, Paris, France, July 2-6, 1973, Proceedings. Brétigny-sur-Orge, Essonne, France, Centre National d'Etudes Spatiales, 1973, p. 417-431.

During the project definition phase, three different solar generator concepts for the three-axis stabilized satellite *Symphonie* were investigated - one version with three rigid arrays, the other with two semiorientable arrays, and the third with two orientable arrays. The major problems and constraints are examined and discussed. This study led to the choice of the fixed version with three nonoriented and body-fixed arrays spaced at 120 deg. Its performance is described. In this configuration, the solar generator will supply the power for a lifetime of 5 years. (Author)

**A74-24936** Photoelectric power engineering. N. S. Lidorenko and A. P. Landsman (Ministry of Electrical Engineering Industry, Moscow, USSR). In: Photovoltaic power and its applications in space and on earth; International Congress on the Sun in the Service of Man, Paris, France, July 2-6, 1973, Proceedings. Brétigny-sur-Orge, Essonne, France, Centre National d'Etudes Spatiales, 1973, p. 477-490.

Advances and improvements in the field of solar batteries are considered. The damage in solar batteries caused by corpuscular radiation can be significantly reduced by increasing the resistance of the silicon base. Other advances are connected with the thermal annealing of radiation damage and the implantation of lithium as a doping ingredient. Improvements in thermal cycle stability are discussed together with high-temperature solar batteries and high-voltage photovoltaic solar converters. G.R.



**A74-24937** Direct energy conversion by means of solar cells. M. S. Erlicki, N. Friedman, D. Schieber, and S. Gavril (Negev, University, Beersheba, Israel). In: Photovoltaic power and its applications in space and on earth; International Congress on the Sun in the Service of Man, Paris, France, July 2-6, 1973, Proceedings. Brétigny-sur-Orge, Essonne, France, Centre National d'Etudes Spatiales, 1973, p. 491-501.

Results for the first two years of work on direct conversion of solar into electrical energy, carried out by our research group, are presented. The study was undertaken with a view to examining the potentialities of solar-cell energy conversion under earth conditions in general, and in Israel in particular. Automatic measurements and recordings in stations dispersed throughout the country are processed by a central system. The design of the stations, and original design techniques for single-cell measurement units and multiple arrays are described. The experimental part of the paper includes a description of the special processing of the meteorological observations, with a view to data on the design of power supplies based on solar cells.

(Author)

**A74-24939** Investigation of photovoltaic applications. B. P. Kelly, J. A. Eckert (ESSO Research and Engineering Co., Linden, N.J.), and E. Berman (Solar Power Corp., Braintree, Mass.; ESSO Research and Engineering Co., Linden, N.J.). In: Photovoltaic power and its applications in space and on earth; International Congress on the Sun in the Service of Man, Paris, France, July 2-6, 1973, Proceedings. Brétigny-sur-Orge, Essonne, France, Centre National d'Etudes Spatiales, 1973, p. 511-518.

Photovoltaic energy systems are described which compete economically with other power sources for terrestrial applications. A detailed description of a silicon solar cell module specifically designed to meet the cost and environmental requirements of various applications is described, including a description of the power conditioning, power storage, and powered equipment and the results of tests and installations in service during the last two years.

(Author)

**A74-24940** Solar generators for sounding balloons (Générateurs solaires pour ballon sonde). Y. Salles (Radiotechnique-Compelec, Caen, France). In: Photovoltaic power and its applications in space and on earth; International Congress on the Sun in the Service of Man, Paris, France, July 2-6, 1973, Proceedings.

Brétigny-sur-Orge, Essonne, France, Centre National d'Etudes Spatiales, 1973, p. 581-586. In French.

Silicon solar arrays provide an excellent means of supplying on-board energy for electronic devices in sounding balloons which must remain some time in the atmosphere. The environmental stresses to which the generators are subjected, are examined. Three types of solar arrays are described together with the technologies developed for their applications and the results obtained.

(Author)

**A74-24941 \*** Conclusions and recommendations of the United States Solar Energy Panel. W. R. Cherry (NASA, Goddard Space Flight Center, Greenbelt, Md.) and F. H. Morse (Maryland, University, College Park, Md.). In: Photovoltaic power and its applications in space and on earth; International Congress on the Sun in the Service of Man, Paris, France, July 2-6, 1973, Proceedings. Brétigny-sur-Orge, Essonne, France, Centre National d'Etudes Spatiales, 1973, p. 587-597. 12 refs.

The United States Solar Energy Panel was charged with assessing the potential of solar energy as a national energy resource. Three areas evolved where solar energy could supply significant amounts of the U.S. future energy needs: (1) energy for heating and cooling of buildings, (2) the production of fuels, and (3) the generation of electrical power. It was concluded that with adequate R&D support over the next 30 years, solar energy could provide at least 35 percent of the heating and cooling of future buildings, greater than 30 percent of the methane and hydrogen needed in the U.S. for gaseous fuels, and greater than 20 percent of the electrical power needs of

the U.S. All of this could be done with a minimal effect on the environment and a substantial savings of nonrenewable fuels.

(Author)

**A74-24942** Space solar power. P. E. Glaser (Arthur D. Little, Inc., Cambridge, Mass.). In: Photovoltaic power and its applications in space and on earth; International Congress on the Sun in the Service of Man, Paris, France, July 2-6, 1973, Proceedings. Brétigny-sur-Orge, Essonne, France, Centre National d'Etudes Spatiales, 1973, p. 599-618. 47 refs.

The results of work carried out on a satellite solar power station (SSPS) since the concept was presented at the 1968 Solar Energy Conference are reviewed. The objective of this concept is to supply electrical power on the earth to provide an economically viable and environmentally and socially acceptable alternative to other energy production methods. The principle on which the SSPS is based relies on solar energy conversion in a satellite in synchronous orbit to produce electricity. This electricity is fed to microwave generators arranged to form an antenna which directs a beam to a receiving antenna on earth, where the microwave energy is efficiently and safely converted back to electricity.

(Author)

**A74-24943** Current prospects for solar cells (Perspectives actuelles des photopiles solaires). M. Rodot and G. Cohen-Solal (CNRS, Laboratoire de Physique des Solides, Meudon, Hauts-de-Seine, France). In: Photovoltaic power and its applications in space and on earth; International Congress on the Sun in the Service of Man, Paris, France, July 2-6, 1973, Proceedings. Brétigny-sur-Orge, Essonne, France, Centre National d'Etudes Spatiales, 1973, p. 619-632. 12 refs. In French.

Review of the current performances and limitations of two generations of solar cells which have been successfully developed. The technical and economic factors which have contributed to the success of both the silicon single-crystal solar cell and the CdS polycrystalline film solar cell are outlined. It is shown that CdS cells make it possible to envisage a large range of applications where an energy cost of the order of 0.01 to 0.1 dollar/watt-hour is admissible. It is concluded that cells with variable forbidden bands, the theory and initial prototypes of which have been developed by Marfaing and Cohen-Solal (1968), should make possible an improvement in the efficiency (up to 25 percent) and cost of photoelectric energy in the not too distant future.

A.B.K.

**A74-24986 #** Spaceborne sources of electric power (Bortovye istochniki elektricheskogo pitaniia). N. I. Sizov and V. K. Shablovskii. Moscow, Voenizdat, 1973. 100 p. 20 refs. In Russian.

The state of the art of power generation systems carried by spacecraft and rocket stages is reviewed, covering solar cells, fuel cells, chemical, biochemical, thermoelectric and thermionic cells, atomic power batteries, and MHD generators. Various electric power converter designs used in spacecraft technology are also considered. Further developments in the field are visualized to meet the growing challenges of spaceflight technology.

V.Z.

**A74-25217** Modelling of combustors - The effects of ambient conditions upon performance. D. Kretschmer and J. Odgers (Université Laval, Quebec, Canada). In: Combustion Institute, European Symposium, Sheffield, England, September 16-21, 1973, Proceedings. London, Academic Press, Inc. (London), Ltd., 1973, p. 451-456. Research supported by the National Research Council of Canada.

The attainability of the very low limits which have been set for 1975/76 automobiles and 1979 gas turbines is studied on the basis of a theoretical model developed to comprise a simple premixed two-stage combustor, with a stirred reactor as the first stage and a dilution zone as the second stage. The performance of the combustion section is calculated from an equation derived by Kretschmer and Odgers (1972), with the aid of which the air and fuel loadings

can be related to the equivalence ratio and combustion efficiency. It is shown that attainment of the low pollution levels will be extremely difficult. Changes in inefficiency due to ambient conditions are very significant at these levels, so that corrective techniques will be essential. Test rig repeatability is also in doubt. V.P.

**A74-25221** Oxidation of carbon monoxide in diluted combustion products at engine idling conditions. F. H. Holderness (National Gas Turbine Establishment, Farnborough, Hants., England). In: Combustion Institute, European Symposium, Sheffield, England, September 18-21, 1973, Proceedings. (A74-25176 10-33) London, Academic Press, Inc. (London), Ltd., 1973, p. 499-504.

The rate of CO burnout under conditions simulating operational engine idling downstream of the dilution plane was determined from a simple study of combustion. In general, the results indicate that for idling conditions, CO is unlikely to be eliminated effectively by oxidation in the fully diluted gas. V.P.

**A74-25352 #** New frontiers of civil aeronautics (Les nouvelles frontières de l'aéronautique civile). C. Abraham (Transports Aériens Réunis, Aéroport de Nice, Nice, France). Association Aéronautique et Astronautique de France and Union Syndicale des Industries Aéronautiques et Spatiales, Congrès International Aéronautique, 11th, Ecole Nationale Supérieure de Techniques Avancées, Paris, France, May 21-23, 1973, Paper. 15 p. In French.

The future development of civil aviation is discussed from the viewpoint of new constraints dictated by considerations of the quality of life and the economic environment. Factors considered include reduction of noise levels, sonic boom hazards, engine exhaust and toxic emission regulations, the availability of aircraft fuels, transport time intervals, availability of airspace, and airport capacity and access problems. The nature of problems posed by each of these factors is discussed along with promising solutions. T.M.

**A74-25481** Trapping of solar energy at Bamako with the aid of a silicon solar cell panel (Sur la captage d'énergie solaire à Bamako à l'aide d'un panneau de cellules solaires au silicium). J. Fléchon (Nancy I, Université, Nancy, France) and L. Keita (Ecole Normale Supérieure, Bamako, Mali). Académie des Sciences (Paris), Comptes Rendus, Série B - Sciences Physiques, vol. 278, no. 8, Feb. 18, 1974, p. 303-306. In French.

Investigation of the optimal use conditions for a solar panel of photovoltaic cells designed to make available directly usable electric energy for the local needs of Sahara-near Sudanese regions lacking electric utility supplies. The tests and studies were conducted at the laboratory of physics of the Bamako Ecole Normale in the Sudan. M.V.E.

**A74-25723** Does research in the field of aeronautics have a future (Hat die Luftfahrtforschung noch eine Zukunft?). G. Brüning and K. Gersten. DGLR Mitteilungen, vol. 7, Feb. 1974, p. 2-6. In German.

Since aviation technology has attained such a high degree of development, the question is raised concerning remaining possibilities for further growth. Clearly, much effort will be devoted to cost reduction and the refinement of present technology. However, many new fields of research are just beginning to be opened up. These include controlled configuration vehicles, the application of computers to engineering problems, the use of computers in navigation systems, noise reduction, atomic fuels, and composite materials. It is stressed that cooperation between European nations will be necessary for overcoming cost limitations in European research. P.T.H.

**A74-25901 \*** Nuclear Science Symposium, 20th, and Nuclear Power Systems Symposium, 5th, San Francisco, Calif., November 14-16, 1973, Proceedings. Symposia sponsored by IEEE, NASA, and AEC. IEEE Transactions on Nuclear Science, vol. NS-21, Feb. 1974, 1012 p.

Subjects considered are in the areas of position sensitive detectors, semiconductor detector materials, semiconductor detector technology, biomedical instrumentation, reactor instrumentation, nuclear instrumentation, and data acquisition and processing. Topics related to photon detection are discussed together with methods for environmental radiation measurement, aspects of environmental gamma-ray analysis, and nuclear techniques for elemental analysis. Attention is also given to operation and design experience with systems at nuclear power plants.

Individual items are announced in this issue.

G.R.

**A74-26324** Solar generator simulation for satellite projects (Solargeneratorsimulation für Satellitenprojekte). A. Schreger. AEG-Telefunken, Technische Mitteilungen, vol. 64, no. 1, 1974, p. 10-15. In German.

The operation of a solar cell power source as used on artificial satellites is outlined. Knowledge of the following parameters of the solar generator is considered necessary for the design of a simulator which will be able to reproduce its voltage-current behavior: the short-circuit current, the discharge voltage, the power output, and the impedance. Both digital and analog simulations are possible, though less problems are connected with analog simulation. The design and operation of an analog simulator are described which can employ either a single solar cell or a Zener diode as a reference element. P.T.H.

**A74-26817** Solar energy conversion for spacecraft. F. C. Treble (Royal Aircraft Establishment, Space Dept., Farnborough, Hants., England). In: Electric propulsion of space vehicles, Proceedings of the Conference, Abingdon, Berks., England, April 10-12, 1973. (A74-26801 11-28) Stevenage, Herts., England, Institution of Electrical Engineers, 1973, p. 89-93.

The design and performance characteristics of modern solar arrays whose basic element is a slice of single-crystal silicon, typically measuring 2 by 2 cm and 300 or 125 microns thick, are discussed. In the n-on-p configuration, a shallow junction is formed by diffusing phosphorus into the boron-doped crystal. Metal contacts are plated or evaporated on the front and back of the cell, and the active surface is coated with an SiO or TiOx antireflective layer. The cell responds to wavelengths between 0.4 and 1.1 micron, peaking at 0.8 to 0.85 micron. The behavior of efficiency as a function of the temperature is examined. Recent developments in large arrays constructed of folded rigid panels or of rolled or folded flexible panels are illustrated and discussed. V.P.

**A74-27136** Turbo-actuators turn flow into mechanical output. P. H. Stahlhuth (Philco-Ford Corp., Newport Beach, Calif.). Hydraulics and Pneumatics, vol. 27, Apr. 1974, p. 89-92.

The design characteristics, principles of operation, and performance of a novel high-force turbine-driven actuator are discussed. Intended for thrust vector control, the actuator converts the power from hot or cold gas flows or from bleed air into mechanical output, and provides a rotary or linear output force in response to input commands. The actuator will operate directly on hot dirty solid-propellant gases, using the same hot-gas control valves which are being used for thrust vector control systems on Minuteman and Poseidon missiles. V.P.

**A74-27320** Nuclear eclectic power. D. J. Rose (MIT, Cambridge, Mass.). Science, vol. 184, Apr. 19, 1974, p. 351-359. 23 refs.

Assessment of the prospects of nuclear electric power production in the context of other power sources and of the current energy demands and resources. The properties, economic costs and demands of nuclear plants, the U.S. uranium resources, nuclear hazards and waste disposal, breeder reactors, controlled fusion, and nuclear vs fossil power are discussed. It is pointed out that there are some reasons, both technological and social, to expect that the increase of nuclear power application for electric power generation will be even greater than had been hitherto anticipated. The impact of this increase on the economy, skilled labor, and capital investments is visualized. V.Z.

**A74-27321 Geothermal electricity production.** G. R. Robson (United Nations, New York, N.Y.). *Science*, vol. 184, Apr. 19, 1974, p. 371-375. 11 refs.

An attempt is made to evaluate the economic, institutional and technological factors which will influence the production of geothermal electricity in the near future. Dry steam and hot water geothermal fields which may be available for electric power generation are assessed. Emphasis is on the U.S. prospects in the field. V.Z.

**A74-27322 Solar energy by photosynthesis.** M. Calvin (California, University, Berkeley, Calif.). *Science*, vol. 184, Apr. 19, 1974, p. 375-381. 32 refs. AEC-sponsored research.

Discussion of the chemical, energetic and economic aspects of solar-to-electric energy conversion by photosynthesis. Several model systems of photosynthetic solar energy conversion are described in detail, including photochemical hydrogen production, carbohydrate and polyisoprene production, and oxygen production by photolysis of binuclear manganese compound. The photoelectric membrane is considered as an agent in the primary quantum conversion event in the green plant. It is anticipated the conversion of carbohydrates from cane or beets through alcohol-to-hydrocarbon fermentation may become economic due to improved fermentation technology and increasing costs of hydrocarbon recovery from fossil sources. V.Z.

**A74-27323 Solar energy utilization by physical methods.** M. Wolf (Pennsylvania, University, Philadelphia, Pa.). *Science*, vol. 184, Apr. 19, 1974, p. 382-386. 16 refs.

Wind power, ocean thermal gradient power, solar heat, and solar-to-electric power conversion are considered as means of solar energy utilization by physical methods. An evaluation is made of total solar energy delivery on the projected U.S. energy economy. It is estimated that the potential sales in photovoltaic arrays alone can exceed \$400 million by 1980 to meet the projected capacity buildup. V.Z.

**A74-27466 # A model of convex programming for turbojet main parameter selection optimization.** C. Turcanu (Institutul de Mecanica a Fluidelor si Constructii Aerospatiale, Bucharest, Rumania). *American Society of Mechanical Engineers, Gas Turbine Conference and Products Show, Zurich, Switzerland, Mar. 30-Apr. 4, 1974, Paper 74-GT-79*. 6 p. Members, \$1.00; nonmembers, \$3.00.

A mathematical modeling of well-known methods used to define turbojet main parameters, aiming at solution optimization, is described. The parameters considered include: compression ratio, maximum temperature for turbine, compressor efficiency, turbine efficiency, and others. A function representing a sum of the ratios describing specific thrust and SFC deviations against maximum specific thrust and minimum SFC, respectively, is derived. Main parameter selection criteria pending on engine operation conditions and aircraft category are introduced. Mathematical analysis for main

parameter selection optimization leads to a convex programming model for which both the function and the constraints are convex functions defined by convex fields. (Author)

**A74-27611 # Complete mechanical energy utilization in aeronautical propulsion systems (O iskorishchenju mekhanichke energije vazdukhoplovnikh pogonskikh grupa).** S. Pivko. *Srpska Akademija Nauka i Umetnosti, Glas, Odeljenje Tehnickikh Nauka*, no. 10, 1973, p. 91-108. In Serbian.

Energy losses during useful power production in reciprocating piston engines and turbojet engines are discussed. Mechanical friction, propeller blade drag and slipstream turbulence and rotation are considered as the causes of energy losses in the former. Mechanical friction, incomplete kinetic-to-pressure energy conversion, air compression in the compressor, incomplete fuel burning, gas flow turbulence, acceleration and drag, combustion product expansion, and incomplete gas-to-kinetic energy conversion in the nozzle are considered as the causes of energy losses in the latter. V.Z.

**A74-27752 # Photoelectric converters based on various CdS heterojunctions (Fotoelektrichni preobrazovateli na osnovata na razlicni kheteroprekhodni k'm kadmiev sulfid).** S. K'nev, E. Konstantinova, V. Stoianov, and R. Stefanov. *B'lgarska Akademiia na Naukite, Fizicheski Institut s ANEB, Izvestiia*, vol. 24, 1973, p. 23-33. 16 refs. In Bulgarian.

The properties of solar-to-electric energy converters are discussed with particular attention to photoelectric converters using CuS-CdS, CuTe-CdS, BiS-CdS, and CrS-CdS junctions. Techniques for obtaining such heterojunctions by electrochemical treatment of respective sulfide materials are described, with details concerning the formation of p-layers. The parameters and performance characteristics of junctions prepared by these techniques are included. Photoconverters produced by these techniques perform steadily in time and have an efficiency of 4 to 6%. V.Z.

**A74-27772 \* # Status of wind-energy conversion.** R. L. Thomas and J. M. Savino (NASA, Lewis Research Center, Cleveland, Ohio). *National Science Foundation, RANN Symposium, Washington, D.C., Nov. 18-20, 1973, Paper 8* p.

The utilization of wind energy is technically feasible as evidenced by the many past demonstrations of wind generators. The cost of energy from the wind has been high compared to fossil fuel systems. A sustained development effort is needed to obtain economical systems. The variability of the wind makes it an unreliable source on a short-term basis. However, the effects of this variability can be reduced by storage systems or connecting wind generators to fossil fuel systems, hydroelectric systems, or dispersing them throughout a large grid network. The NSF and NASA-Lewis Research Center have sponsored programs for the utilization of wind energy. F.R.L.

**A74-27775 \* # H2-O2 combustion powered steam-MHD central power systems.** G. R. Seikel, J. M. Smith, and L. D. Nichols (NASA, Lewis Research Center, Cleveland, Ohio). *University of Miami, Hydrogen Economy Miami Energy Conference, Miami Beach, Fla., Mar. 18-20, 1974, Paper*. 13 p. 9 refs.

Estimates are made for both the performance and the power costs of H2-O2 combustion powered steam-MHD central power systems. Hydrogen gas is assumed to be transmitted by pipe from a remote coal gasifier into the city and converted to electricity in a steam MHD plant having an integral gaseous oxygen plant. These steam MHD systems appear to offer an attractive alternative to both in-city clean fueled conventional steam power plants and to remote coal fired power plants with underground electric transmission into the city. (Author)

**A74-27833 #** Solar vs. nuclear power - Is there a choice. B. Raab and J. J. Karlin (Fairchild Space and Electronics Co., Germantown, Md.). *American Institute of Aeronautics and Astronautics, Communications Satellite Systems Conference, 5th, Los Angeles, Calif., Apr. 22-24, 1974, Paper 74-489*. 14 p. 12 refs. Members, \$1.50; nonmembers, \$2.00. Contract No. AT(49-15)-3063.

The anticipated development of advanced high-performance radioisotope power systems has motivated a new evaluation of their possible utility in earth-orbit missions. These have been compared, in detailed spacecraft design studies, with current and improved oriented-solar-array/battery systems in commercial synchronous-orbit application. It is concluded that the nuclear systems would be economically superior to current solar systems, including violet cells, and potentially competitive with systems employing nickel-hydrogen batteries. This results in part from significant reductions in house-keeping power, and in the weights of other subsystems, which can be achieved with nuclear power. (Author)

**A74-27842 #** Reduction of TACV power requirements by multiple-stage air cushions. W. R. Eberle (Purdue University, Lafayette, Ind.). *Journal of Aircraft*, vol. 11, Mar. 1974, p. 154-159. 6 refs. NSF Grant No. GK-2773.

One of the problems associated with tracked air cushion vehicles (TACVs) is their high power requirement. It is shown that the power required for levitation for such vehicles can be significantly reduced by the use of multiple-stage air cushions. A mathematical model for these air cushions is developed, and the air cushion pressures obtained from the model are compared with experimental pressures. It is shown that one of the most significant features of multiple-stage air cushions is their inherent roll stability as opposed to an inherent instability for conventional air cushion designs. This inherent roll stability allows a significant reduction in the power required for levitation for tracked air cushion vehicles. (Author)

**A74-28311** Engine sensory requirements for energy management. I. A. Carnegis (USAF, Flight Dynamics Laboratory, Wright-Patterson AFB, Ohio). In: *Instrumentation for airbreathing propulsion; Proceedings of the Symposium, Monterey, Calif., September 19-21, 1972*. Cambridge, Mass., MIT Press, 1974, p. 419-436.

Advanced high-performance military fighter and bomber systems must use an advanced technique of energy management. Energy management in terms of optimum throttle and flight path will yield significant improvements in fuel, time, and distance over conventionally operated aircraft. Nominal flight path performance for certain mission segments is compared to fixed throttle optimum flight path performance and to variable throttle optimum flight path performance. Mission throttle control parameters are identified that can be measured in the engine and on the airframe during flight. These parameters are used to serve as indicators of the optimum throttle position. This avoids the necessity of carrying extensive throttle position data on board the aircraft. Sensors and transducers that may be used in the flight control/engine throttle control system are discussed. (Author)

## STAR ENTRIES

**N74-15734\*# Kanner (Leo) Associates, Redwood City, Calif.  
WIND ENERGY: ITS VALUE AND THE CHOICE OF SITE  
FOR EXPLOITATION**

P. Ailleret Washington NASA Jan. 1974 20 p Transl. into ENGLISH from Rev. Gen. Elec. (Paris), v. 55, Mar. 1946 p 103-108

(Contract NASw-2481)

(NASA-TT-F-15311) Avail: NTIS HC \$3.00 CSCL 10A

The problem of wind power utilization is discussed, including determination of wind power per square meter obtained yearly from surfaces subjected to wind action, and systematic prospecting for favorable sites using a simple anemometric device which calculates wind speed with the aid of a special electric meter. A description is given of a program for site selection which will make it possible to determine the energy which can be produced by the wind engines used.

Author

**N74-15739\*# Scientific Translation Service, Santa Barbara, Calif.  
HIGH POWERED ELECTRICAL POWER GENERATION BY  
WIND MOTORS**

M. Kloss Washington NASA Feb. 1974 11 p ref. Transl. into ENGLISH from Elektrotech. Z. (West Berlin), v. 72, no. 7, 1 Apr. 1951 p 201-202

(Contract NASw-2483)

(NASA-TT-F-15303) Avail: NTIS HC \$3.00 CSCL 10A

The development of a wind wheel for electric power generation is discussed. The interaction between the wind wheel and the generator is accomplished with a power control device to prevent overloading the generator when the wind velocity increases. The self-controlled running wheel of the wind motor adjusts the blade angle of attack to compensate for the wind velocity. The generator must be dimensioned for the greatest wind intensity in order to accept the entire wind wheel power. The wind generation installation delivers all of the produced energy to the network so that other generating stations operating in parallel and the storage units must adjust the power level to the consumers.

Author

**N74-15740\*# Techtran Corp., Glen Burnie, Md.  
NEUWERK WINDMILL POWER GENERATION PLANT**

W. Mackenthun Washington NASA Jan. 1974 12 p refs Transl. into ENGLISH from Elektrizitaetswirtschaft (Frankfurt am Main), no. 11, Nov. 1951 p 322-325

(Contract NASw-2485)

(NASA-TT-F-15306) Avail: NTIS HC \$3.00 CSCL 10A

The installation and characteristics of a windmill power generation plant are discussed. The meteorological parameters of the German North Sea Coast which influenced the location of the windmill power generating system are analyzed. The regulating devices for compensating for changes in wind velocity are described. Results of the power generation operation for the year 1950 are tabulated.

Author

**N74-15741\*# Scientific Translation Service, Santa Barbara, Calif.  
ECONOMY AND PRACTICAL APPLICATIONS OF LARGE  
WIND-DRIVEN POWER PLANTS, PART 1**

H. Witte Washington NASA Feb. 1974 14 p refs Transl. into ENGLISH from Elektrotech. Z. (Berlin), v. 59, no. 51, 22 Dec.

1938 p 1373-1376

(Contract NASw-2483)

(NASA-TT-F-15308) Avail: NTIS HC \$3.00 CSCL 10A

The question of the economy of large scale wind electrical generating stations is investigated based on present findings. By exploiting wind energy for producing electrical power, large amounts of coal could be made available for other uses, and would also ease our foreign currency situation. The practical aspects of large scale wind electrical power generating plants are discussed. The construction of a ring generator is described.

Author

**N74-15742\*# Kanner (Leo) Associates, Redwood City, Calif.  
WIND-POWERED MACHINES**

Ya. I. Shefter Washington NASA Jan. 1974 279 p refs Transl. into ENGLISH of the book "Vetroenergeticheskiye Agregaty" Moscow, Mashinostroyeniye Press, 1972 288 p

(Contract NASw-2481)

(NASA-TT-F-15149) Avail: NTIS HC \$16.00 CSCL 10A

The basic problems connected with the selection of layouts and calculation of parameters of wind machines, their energy-producing characteristics and technical and economic indices are presented. Methods of optimal matching of wind engines with working machines, calculators for strength, and construction and automation of wind machines are analyzed in detail. A description is given of the setup of domestic and foreign wind installations for various purposes. Basic characteristics of wind as a source of energy, brief information from aerodynamics, the theory of the wind engine and calculation of its aerodynamic characteristics are presented. In conclusion, recommendations are presented for use of wind machines according to zone. The book is intended for engineers, designers and workers of scientific and research institutes connected with creation and utilization of wind machines and for engineers and mechanics in agriculture.

Author

**N74-15743\*# Kanner (Leo) Associates, Redwood City, Calif.  
WIND POWER PLANTS IN RUSSIA**

Th. Sauer Washington NASA Feb. 1974 7 p refs Transl. into ENGLISH from VDI (Ver. Deut. Ing.) Z. (West Germany), v. 81, no. 32, 7 Aug. 1937 p 947-948

(Contract NASw-2481)

(NASA-TT-F-15331) Avail: NTIS HC \$3.00 CSCL 10B

Several measures relative to wind power plants have been taken by the Soviet government, and are outlined. The large Balaklava wind power plant is described briefly. The wind power experimental facility in Moscow is illustrated in a diagram and its operation discussed in some detail.

Author

**N74-15745\*# Kanner (Leo) Associates, Redwood City, Calif.  
OBSERVATIONS ON MODERN WIND-ELECTRIC POWER  
PLANTS**

G. Serragli Washington NASA Feb. 1974 22 p refs Transl. into ENGLISH from Elettrotecnica (Italy), v. 34, 10-25 Dec. 1947 p 494-498

(Contract NASw-2481)

(NASA-TT-F-15357) Avail: NTIS HC \$3.25 CSCL 10B

Development of the aeronautical type windmill design and the installation of wind-powered electricity plants is held feasible for Italy undergoing post-war reconstruction. It is shown to be possible to build from 200 to 300 small capacity power plants for a total output of 10,000 to 15,000 kW in areas of Italy which have the minimum necessary wind speed of 5.5 m/sec. Among the designs required for such wind electricity plants are windmill blades with variable pitch, automatic pitch control system which does not use the costly servomotor, and reversible wheels. These features enable a windmill of limited orientability to function with high efficiency. The effect of wind rose patterns, the surface area of the blade, and some possible local uses of the electricity produced by such plants are also discussed.

Author

**N74-15746\*# Scientific Translation Service, Santa Barbara, Calif.  
IMPORTANCE AND PROGRESS OF WIND POWER  
UTILIZATION IN DENMARK**

Dimitry Stein Washington NASA Feb. 1974 11 p refs Transl. into ENGLISH from Elektrizitaetswirtschaft (Frankfurt am Main), v. 41, no. 47, 5 Sep. 1942 p 390-392 (Contract NASw-2483)

(NASA-TT-F-15353) Avail: NTIS HC \$3.00 CSCL 10B

Experience derived in operating wind power systems in Denmark is described. A study is made of the efficiency of the Danish power plants. Author

**N74-15747\*** Scientific Translation Service, Santa Barbara, Calif.

**CHARACTERISTIC LINES (YEARLY PERMANENT LEVEL LINES) AND CHARACTERISTIC WIND VARIABLES FOR WIND ENERGY PRODUCTION**

H. Pigge Washington NASA Feb. 1974 25 p refs Transl. into ENGLISH from Elektrizitaetswirtschaft (Frankfurt am Main), v. 54, no. 20, Oct. 1955 p 704-709

(Contract NASw-2483)

(NASA-TT-F-15354) Avail: NTIS HC \$3.25 CSCL 10B

Optimum design methods for wind driven electrical generating plants are presented, based on yearly permanent wind level lines for selected erection sites. Wind conditions at any site are divided into five classes, of which only a few can be exploited by a given system. General purpose design curves are given. Author

**N74-15748\*** Linguistic Systems, Inc., Cambridge, Mass.

**METHOD OF CALCULATION OF ANNUAL OVERALL EFFICIENCY OF MODERN WIND-POWER PLANTS**

F. D. Pigeaud Washington NASA Feb. 1974 13 p refs Transl. into ENGLISH from Ingenieur (The Hague), v. 63, no. 47, 23 Nov. 1971 p W137-W140

(Contract NASw-2482)

(NASA-TT-F-15310) Avail: NTIS HC \$3.00 CSCL 10B

A method of calculating the annual overall efficiency of modern wind power plants equipped with asynchronous generators is reported that takes into account the annual velocity duration curve at Den Helder, Holland. A comparison is made between variable pitch windmotor and fixed blade windmotor equipped with movable flaps. A careful calculation is recommended in view of rather small differences in efficiency for both systems. Author

**N74-15749\*** Kanner (Leo) Associates, Redwood City, Calif.

**PROBLEMS IN THE ELECTRICAL EQUIPMENT OF WIND POWER PLANTS**

M. Kloss Washington NASA Feb. 1974 42 p refs Transl. into ENGLISH from Technik (Berlin), v. 2, Nov. 1947 p 471-479

(Contract NASw-2481)

(NASA-TT-F-15312) Avail: NTIS HC \$4.25 CSCL 10B

Problems encountered in electric installations of wind power plants are discussed. Difficulties involved necessitate close cooperation of aerodynamic and electrical engineer in implementing wind power plants for d-c and a-c currents. Examples of actual installations in Germany are presented; a present task is erection of small wind power plants for farms. Author

**N74-15750\*** Scientific Translation Service, Santa Barbara, Calif.

**THE LARGE SCALE WIND DRIVEN ELECTRICAL GENERATING STATION**

H. Mayer Washington NASA Feb. 1974 10 p refs Transl. into ENGLISH from Technik (Berlin), v. 2, no. 12, Dec. 1947 p 527-528

(Contract NASw-2483)

(NASA-TT-F-15313) Avail: NTIS HC \$3.00 CSCL 10B

Large wind power plants and their use to alleviate coal shortage in Germany are discussed. It is stipulated that there is no economic necessity for development of large scale wind power plants before possible improvements in steam power plants, such as combined heating and power plants, high pressure plants, etc. have been exhausted. A table gives comparison of costs and efficiency of wind and steam power plants. Author

**N74-15751\*** Scientific Translation Service, Santa Barbara, Calif.

**UTILIZATION OF WIND POWER WITH WARD-LEONARD TYPE CIRCUIT IN INVERTED OPERATION**

A. Carrier Washington NASA Feb. 1974 13 p Transl. into ENGLISH from Elettrotecnica (Italy), v. 36, 10-25 Aug. 1949 p 383-385

(Contract NASw-2483)

(NASA-TT-F-15352) Avail: NTIS HC \$3.00 CSCL 10B

An electric circuit is described comprising two direct current machines and one three-phase synchronous or an asynchronous induction machine suitable for transforming and feeding the energy from the wind into a three-phase conventional electric power network. Author

**N74-15752\*** Kanner (Leo) Associates, Redwood City, Calif.

**UTILIZATION OF WIND POWER IN AGRICULTURE IN THE USSR**

D. Stein Washington NASA Feb. 1974 13 p refs Transl. into ENGLISH from Elektrizitaetswirtschaft (West Germany), v. 40, no. 4, 5 Feb. 1941 p 54-56

(Contract NASw-2481)

(NASA-TT-F-15345) Avail: NTIS HC \$3.00 CSCL 10B

Wind motors are being used in Russian agriculture for milling and pumping water. Plans call for rapid expansion of the utilization of such power plants. The extent of present utilization, problems, and forecasts are outlined. Author

**N74-15753\*** Kanner (Leo) Associates, Redwood City, Calif.

**PROGRESS IN THE UTILIZATION OF WIND POWER**

G. W. Meyer Washington NASA Feb. 1974 14 p refs Transl. into ENGLISH from Elektrizitaetsverwertung (Switzerland), v. 16, no. 6/7, Sep.-Oct. 1941/42 p 109-113

(Contract NASw-2481)

(NASA-TT-F-15346) Avail: NTIS HC \$3.00 CSCL 10B

Wind power continues to be of interest as a source of energy for isolated locations. In order to distribute the capital costs over many service hours, the wind motors should be able to exploit low wind speeds. Low speed wind motors can be used only for driving slow machinery. High speed wind motors to drive small dynamos are now available which are self starting at low wind speeds. Large scale wind power stations have not yet passed the experimental stage. Author

**N74-15754\*** Scientific Translation Service, Santa Barbara, Calif.

**IMPORTANCE AND PROGRESS OF WIND POWER UTILIZATION IN DENMARK**

Dimitry Stein Washington NASA Feb. 1974 19 p Transl. into ENGLISH from Elektrizitaetswirtschaft (Frankfurt am Main), v. 41, no. 16, 20 Aug. 1942 p 370-374

(Contract NASw-2483)

(NASA-TT-F-15349) Avail: NTIS HC \$3.00 CSCL 10B

The designs of various wind power plants in Denmark are discussed. Price lists for the plants are given along with prices for direct current generators for wind power plants. Author

**N74-15755\*** Kanner (Leo) Associates, Redwood City, Calif.

**MEDIUM-CAPACITY AIR MOTOR PILOT PLANT WITH HYDRAULIC ENERGY ACCUMULATION BY PUMPING**

Renzo Vezzani Washington NASA Feb. 1974 72 p refs Transl. into ENGLISH from Elettrotecnica (Italy), v. 37, 15-25 Sep. 1950 p 398-419

(Contract NASw-2481)

(NASA-TT-F-15299) Avail: NTIS HC \$5.75 CSCL 10B

An air motor power plant is to be erected on the island of Giglio, Italy. Slow speed orientable windmill designs are replaced by high speed air motors, protected and fixed in space. The entire air motor is placed in a tubular system similar to a Venturi tube. The operation of the enclosed air motor may be regarded as similar to that of a Kaplan turbine. Author

**N74-15756\*** Techtran Corp., Glen Burnie, Md.

**UTILIZATION OF WIND POWER**

J. W. VanHeys Washington NASA Feb. 1974 11 p refs Transl. into ENGLISH from Elektrotech. Z. (Berlin), v. 64, no. 34

22 Aug. 1940 p 787-790

(Contract NASw-2485)

(NASA-TT-F-15300) Avail: NTIS HC \$3.00 CSCL 10B

The possible power of wind in a wind turbine is determined. From available wind measurements the wind frequency line is plotted to provide the basis for the design of a wind turbine. Favorable results are not obtained if work is continued on the previous principle of mill construction. There are only two ways of achieving adequate power: enlarging the circumference described by the vane and utilizing higher wind velocities. The latter are present at an altitude of about 200 meters above the ground. Satisfactory performance is attained with a vane length of 60 meters. Thus it is recommended that tests running at least one year be instituted with these dimensions. Author

**N74-15757\*** Scientific Translation Service, Santa Barbara, Calif.

**THE DIRECT DRIVING OF SYNCHRONOUS GENERATORS BY LARGE SCALE WIND ELECTRICAL POWER GENERATING PLANTS IN PARALLEL OPERATION WITH A SYNCHRONIZING NETWORK, PART 1**

Max Kloss Washington NASA Feb. 1974 27 p ref Transl. into ENGLISH from Elektrotech. Z. (West Germany), v. 63, 13 Aug. 1942 p 362-367

(Contract NASw-2483)

(NASA-TT-F-15301) Avail: NTIS HC \$3.50 CSCL 10B

The damped eigen oscillation of a synchronous generator connected with a fixed network is investigated. It is assumed that the generator is driven by a wind propeller wheel. The influence of the variation of the characteristic of the propeller wheel on the variation of the transient oscillatory behavior is investigated. First the wind velocity increase occurs suddenly and then in a continuous fashion. The power control measures including propeller pitch displacement are investigated for preventing overloads on the generator. The danger of resonance is pointed out. This depends on the number of propellers. The question is discussed of whether it is better to use an asynchronous generator instead of a synchronous generator. Author

**N74-15758\*** Kanner (Leo) Associates, Redwood City, Calif.  
**THE IMPORTANCE OF AND PROGRESS IN THE UTILIZATION OF WIND POWER IN DENMARK**

Dimitry Stein Washington NASA Feb. 1974 17 p refs Transl. into ENGLISH from Elektrizitaetswirtschaft (Germany), v. 41, no. 15, 5 Aug. 1942 p 346-349

(Contract NASw-2481)

(NASA-TT-F-15333) Avail: NTIS HC \$3.00 CSCL 10B

Denmark was one of the first countries to turn its attention to generating electric energy from wind power, because it has to import all oil and coal it uses, and it has virtually no hydroelectric power. A large number of wind power stations were built in the early years of World War I when fuel was scarce. The total production of wind power was estimated at approximately 1.8 million kWh in 1941. The installation of wind power stations was generally considered to be a temporary measure. Author

**N74-15759\*** Kanner (Leo) Associates, Redwood City, Calif.  
**APPLICATION OF WIND POWER TO RATIONAL GENERATION OF ELECTRICITY**

J. Juul Washington NASA Feb. 1974 28 p refs Transl. into ENGLISH from Elektrotekniker (Denmark), v. 43, 7 Aug. 1947 p 137-148

(Contract NASw-2481)

(NASA-TT-F-15334) Avail: NTIS HC \$3.50 CSCL 10B

The history and development of windmills in Denmark and elsewhere is sketched. The costs and problems of generating electricity by steam, water and wind power are compared. Pointing out that the wind is Denmark's only major natural source of power and dividing the application of wind power into an economic and a technological part, it is discussed how the Danish wind could be harnessed to supply power not only in the requisite amounts and at the lowest cost, but also under all circumstances, so as to make Denmark self-sufficient in the matter of energy. Author

**N74-15760\*** Kanner (Leo) Associates, Redwood City, Calif.  
**INVESTIGATION OF THE POSSIBILITIES OF USING WIND POWER**

C. Kromann and J. Juul Washington NASA Feb. 1974 11 p Transl. into ENGLISH from Elektrotekniker (Denmark), v. 45, 7 Dec. 1949 p 711-714

(Contract NASw-2481)

(NASA-TT-F-15336) Avail: NTIS HC \$3.00 CSCL 10B

Kromann's critique of several of Juul's articles in Elektrotekniker and of Juul's riposte is reported. For example, Kromann argues that it should not be expected that wind tunnel experiments, necessary as these are for finding the best vane design, will yield the same results as real conditions; Juul counters that the same efficiency can be obtained in the open air as in a wind tunnel and that, in any case, this point will be investigated in greater detail in the near future. Kromann has misgivings about building windmills on the west coast of Jylland because he fears that the force of the wind there is too variable; Juul counters that wind force measurements show that this fear is unfounded (the corresponding curves are given). Author

**N74-15761\*** Kanner (Leo) Associates, Redwood City, Calif.  
**AIR POWER PLANTS IN RUSSIA AND THE UNITED STATES (FROM DIMITRY STEIN. ELEKTRIZITAETSWIRTSCH., VOLUME 40, NO. 16, 1941)**

Washington NASA Feb. 1974 5 p Transl. into ENGLISH from Bull. Assoc. Suiss Electriciens (Zurich), v.33, no. 1, 1942 p 17-18

(Contract NASw-2481)

(NASA-TT-F-15338) Avail: NTIS HC \$3.00 CSCL 10A

Various types of wind power plants in the USSR and in the USA are discussed. The VIME D-12 in Crimea, a large power plant, is described. Uses mentioned for the USA are running farm machinery, protecting pipes from corrosion due to leakage currents, and supplying power to amplifiers for telephone wires. Author

**N74-15762\*** Scientific Translation Service, Santa Barbara, Calif.

**PARALLEL OPERATION OF A SYNCHRONOUS GENERATOR AND AN INFINITELY HIGH-POWERED NETWORK WHEN DRIVEN BY A HONNEF-GROSS WIND TURBINE**

Ludwig Linner Washington NASA Feb. 1974 14 p refs Transl. into ENGLISH from Elektrotech. Z. (West Berlin), v. 69, no. 9, Sep. 1948 p 293-296

(Contract NASw-2483)

(NASA-TT-F-15302) Avail: NTIS HC \$3.00 CSCL 10B

An infinite high powered network is described as a network whose voltage is independent of the load states of the connected machines, and whose voltage amplitude and angular velocity is always the same. The three-phase generator operating in conjunction with this network must operate at a constant rotation rate, as must the wind wheel according to the number of its poles and the frequency of the network. The variation in the power output of a wind wheel is discussed for constant rotation rate as a function of wind velocity in order to evaluate the operational characteristics of a synchronous machine. Author

**N74-15763\*** Scientific Translation Service, Santa Barbara, Calif.

**ANTENNA TOWERS AS WIND TOWER GENERATION PLANTS**

H. Pigge Washington NASA Feb. 1974 10 p refs Transl. into ENGLISH from Elektrotech. Z. (West Berlin), v. 73, no. 4, 15 Feb. 1952 p 95-96

(Contract NASw-2483)

(NASA-TT-F-15304) Avail: NTIS HC \$3.00 CSCL 10B

A variety of wind power generating plants are considered to be installed on FM antenna masts. These include: Savonius rotor, horizontal axis wind wheels, multi-rotor configurations. Power levels vary between 10-20 kW for 100 meter mast heights. Author

**N74-15764\*** Kanner (Leo) Associates, Redwood City, Calif.  
**WIND ENERGY**

G. Lacroix Washington NASA Feb. 1974 28 p refs Transl.

into ENGLISH from Tech. Mod. (Paris), v. 41, nos. 5 and 6, 1 and 15 Mar. 1949 p 77-83

(Contract NASw-2481)

(NASA-TT-F-15342) Avail: NTIS HC \$3.50 CSCL 10B

The technical and economic problems involved in the use of wind engines as a source of power are discussed, with detailed descriptions of the operative principles behind several basic types. Author

**N74-15765\*# Kanner (Leo) Associates, Redwood City, Calif. USING LARGE WIND POWER PLANTS TO DIRECTLY DRIVE SYNCHRONOUS GENERATORS IN PARALLEL OPERATION WITH A GOVERNING NETWORK**

Max Kloss Washington NASA Feb. 1974 19 p Transl. into ENGLISH from Elektrotechn. Z. (West Germany), v. 63, 27 Aug. 1942 p 388-392

(Contract NASw-2481)

(NASA-TT-F-15343) Avail: NTIS HC \$3.00 CSCL 10B

Various aspects of wind powered synchronous generators are described. The influence of the fan wheel characteristic on damping of transients is slight. Altering vane position is the only feasible method for regulating power in order to avoid overloading the generator. In designing the fan wheel, and choosing the number of vanes, the operating behavior of the generator and the danger of resonance must be considered ahead of efficiency. Practical operating characteristics of the fan wheel must be known to the electrical engineer if he is to calculate the course of events during a transient. Author

**N74-15766\*# Kanner (Leo) Associates, Redwood City, Calif. PROSPECTS FOR THE UTILIZATION OF WIND ENERGY IN CZECHOSLOVAKIA**

F. Sembera Washington NASA Feb. 1974 25 p Transl. into ENGLISH from Elektrotechnicky Obzor (Czechoslovakia), v. 38, Sep. 1949 p 477-484

(Contract NASw-2481)

(NASA-TT-F-15305) Avail: NTIS HC \$3.25 CSCL 10B

Technical and economical conditions for the utilization of airstreams in Czechoslovakia are considered. The probable mean wind velocities in various districts of the country, their number and the probable daily and yearly charts at various altitudes, the most windy districts, the possibilities and extent of utilizing the airstreams by power stations equipped with prime movers with a 50 m propeller diameter and a 30-35 m high tower are investigated and presented on the basis of many years of observation. It is determined that the power stations in

**N74-15767\*# Kanner (Leo) Associates, Redwood City, Calif. NEW WIND POWER STATION**

E. Rogge and O. Stein Washington NASA Feb. 1974 21 p refs Transl. into ENGLISH from Elektrizitaetswirtschaft (West Germany), v. 42, no. 14, 5 Nov. 1943 p 358-363

(Contract NASw-2481)

(NASA-TT-F-15332) Avail: NTIS HC \$3.25 CSCL 10B

A wind power plant is described which was used during the fuel shortage that occurred in World War 2. Unlike ordinary wind power plants which produced usable power only at wind velocities above 4 or 5 m/s, this power plant was designed to operate over a wide range, charging its battery at low wind speeds, delivering usable power from generator and discharging battery at intermediate speeds, and delivering power and charging its batteries at high wind speeds. The result was exploitation of the wind for a larger number of hours per year and lower costs per kWh of output. Author

**N74-15768\*# Kanner (Leo) Associates, Redwood City, Calif. WIND-POWER SUPPLY FOR THE DECIMETER RANGE DIRECTIONAL RADIO SITE AT SCHOENEBOURG (EIFEL) AND THE EXPERIENCE GAINED**

G. Rosseler Washington NASA Feb. 1974 29 p refs Transl. into ENGLISH from Nachrichtentech. Z. (West Germany), v. 12, Jul. 1959 p 352-360

(Contract NASw-2481)

(NASA-TT-F-15337) Avail: NTIS HC \$3.50 CSCL 10B

The Schoeneburg directional radio station is located far from

public power lines on a hilltop where the average wind velocity is 5.6 m/sec. The station, as first designed, required 26 kWh/day of dc power. It uses two Allgaier wind power systems, Dr. Hutter type WE/G 6, with a nominal output of 6 kW at 9 m/sec and 1 kW at 4.2 m/sec wind velocity mounted on two 10-m high tubular poles. The dc generators are differentially compounded, shunt-wound. Lead storage batteries of 110 cells and 218 Ah are used to stabilize the output and store the energy. A diesel generator system is available as an emergency system. Tests show that more than 90% of the power required for the initial unmodified communications system could probably have been supplied by the wind power system. The results were completely positive. Wind power stations are economically advantageous where it is very expensive to connect to the public power system, where adequate wind is available and especially when only a moderate amount of power is required. Author

**N74-15769\*# Scientific Translation Service, Santa Barbara, Calif. THE UTILIZATION OF THE WIND ENERGY**

Renzo Vezzani Washington NASA Feb. 1974 11 p Transl. into ENGLISH from Elettrotecnica (Milan), v. 34, Nov. 1947 p 463-464

(Contract NASw-2483)

(NASA-TT-F-15344) Avail: NTIS HC \$3.00 CSCL 10B

Wind energy exploitation by very large wind power generating stations is discussed. This system is compared to other types of power generation. Author

**N74-15770\*# Scientific Translation Service, Santa Barbara, Calif. SMALL WIND-ELECTRICAL INSTALLATIONS FOR EXPORT**

G. R. Seidel Washington NASA Feb. 1974 11 p refs Transl. into ENGLISH from Elektrotechn. Z. (West German), v. 70, no. 5, May 1949 p 158-160

(Contract NASw-2483)

(NASA-TT-F-15350) Avail: NTIS HC \$3.00 CSCL 10B

The design and operational problems are reported that are associated with wind power generating plants similar to the American wind charger. The potential market for such devices is discussed. Author

**N74-15776# Informatics, Inc., Rockville, Md. SOVIET GEOTHERMAL ELECTRIC POWER ENGINEERING, REPORT 2**

V. A. Stevovich Dec. 1972 85 p refs

(Contract F44620-72-C-0053; ARPA Order 1622-3)

(AD-754947; AFOSR-73-0034TR) Avail: NTIS CSCL 10/2

Information is provided on Soviet geothermal research and engineering associated with the design, construction, and maintenance of geothermal power plants and related facilities. Besides a general outline of geothermal characteristics, emphasis in this report is on Soviet geothermal research and development, including engineering data on existing power plants, as well as those under construction and in the planning stages. Other actual and potential applications of geothermal water such as for space heating, hotwater supply, mining and construction in permafrost regions, refrigeration, air conditioning, agriculture, medical and health applications, etc., are discussed.

Author (GRA)

**N74-15777# Army Foreign Science and Technology Center, Charlottesville, Va. SOME RESULTS OF TESTING OF A SOLAR WATER HEATING INSTALLATION DURING THE HEATING SEASON**

G. Ya. Umarov, R. A. Zakhidov, and R. R. Avezov 31 Oct. 1972 4 p Transl. into ENGLISH from Gellotekhnika (USSR), no. 4, 1970 p 85-86

(AD-754628; FSTC-HT-23-1011-72) Avail: NTIS CSCL 13/1

An experimental investigation of solar water heating plant with operating surface 2 sqm, mounted at the angle 50 degrees with the horizon are given. The possibility and expediency of solar energy application as a low potential heat source for the heating pump in heating regime are described. Author (GRA)



**N74-15808#** Bureau of Mines, Pittsburgh, Pa. Energy Research Center.

**ANALYSES OF TARS, CHAR, GASES, AND WATER FOUND IN EFFLUENTS FROM THE SYNTHANE PROCESS** Technical Progress Report

Albert J. Forney, William P. Haynes, Stanley J. Gasior, Glenn E. Johnson, and Joseph P. Strakey, Jr. Jan. 1974 12 p refs (BM-TPR-76) Avail: NTIS HC \$3.00 CSCL 07D

Extensive studies were made of the various effluents found in the synthane coal-to-gas process. Analyses were made of the waters, gases, and trace elements present in some of the streams. Analyses results show that the water effluent area needs further research. Author

**N74-15817#** Army Coating and Chemical Lab., Aberdeen Proving Ground, Md.

**THERMAL-OXIDATIVE STABILITY OF AUTOMOTIVE DIESEL FUELS** Interim Report

Maurice E. LePera Feb. 1973 42 p refs (DA Proj. 170-62105-A-106)

(AD-758146; CCL-321) Avail: NTIS CSCL 21/4

The thermal oxidation characteristics of diesel fuels are studied. Because of the absence of any laboratory bench-scale techniques designed to predict these fuel filter plugging and/or injector fouling tendencies, initial experimentation was directed towards developing an accelerated thermal-oxidation technique. To establish valid test conditions actual diesel fuel system temperatures were obtained from engineering and service (E and S) test programs and also monitored under road dynamometer testing. A second attempt involved the use of an ASTM-CRC fuel coker which was operated in a recycle mode to simulate the geometry of automotive diesel fuel systems. Initial experiments with this technique have revealed its capability to differentiate diesel fuel quality in terms of thermal-oxidation stability. Author (GRA)

**N74-15908** Rensselaer Polytechnic Inst., Troy, N.Y.

**LONG RANGE TRENDS IN THE CHARACTER OF ELECTRIC POWER SYSTEMS** Ph.D. Thesis

Charles A. Falcone 1973 388 p

Avail: Univ. Microfilms Order No. 73-27204

Long range trends in the development of electric power systems in the United States are discussed, emphasizing the Midwestern region. The historical growth of energy consumption in the United States is examined, along with present status and near-term prospects. Demographic and societal trends are discussed, and energy and electric power consumption are projected to year 2100, based on a scenario of future American society. The fuel resources of the United States are examined, as well as current and developmental energy conversion technology. A forecast of fuel use is developed. A history of energy systems is epitomized, with particular attention to electric power systems. Alternative energy systems are compared, and an examination of a hydrogen-electric system is included.

Dissert. Abstr.

**N74-16007#** Indiana Geological Survey, Bloomington. Coal Section.

**APPLICATION OF ERTS-1 IMAGERY TO FRACTURE RELATED MINE SAFETY HAZARDS IN THE COAL MINING INDUSTRY** Progress Report, 1 Jul. 1973 - 1 Jan. 1974

Charles E. Wier, Frank J. Wobber, Principal Investigators, Orville R. Russell, Roger V. Amato, and Thomas V. Leshendok Jan. 1974 27 p ref Prepared in cooperation with Earth Satellite Corp., Washington, D. C. ERTS (Contract NAS5-21795)

(E74-10238; NASA-CR-136538) Avail: NTIS HC \$3.50 CSCL 081

The author has identified the following significant results. New fracture detail of Indiana has been observed and mapped from ERTS-1 imagery. Studies so far indicate a close relationship between the directions of fracture traces mapped from the imagery, fractures measured on bedrock outcrops, and fractures measured in the underground mines. First hand observations and discussions with underground mine operators indicate good correlation of

mine hazard maps prepared from ERTS-1/aircraft imagery and actual roof falls. The inventory of refuse piles/slurry ponds of the coal field of Indiana has identified over 225 such sites from past mining operations. These data will serve the State Legislature in making tax decisions on coal mining which take on increased importance because of the energy crisis.

**N74-16019#** Indiana Geological Survey, Bloomington.

**APPLICATION OF EREP IMAGERY TO FRACTURE-RELATED MINE SAFETY HAZARDS AND ENVIRONMENTAL PROBLEMS IN MINING** Quarterly Progress Report, 20 Oct. 1973 - 20 Jan. 1974

Charles E. Wier, Frank J. Wobber, Roger V. Amato, and Orville R. Russell, Principal Investigators 22 Jan. 1974 14 p ref Prepared in cooperation with Earth Satellite Corp., Washington, D. C. Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (Contract NAS9-13358)

(E74-10258; NASA-CR-136586; QPR-3) Avail: NTIS HC \$3.00 CSCL 081

The author has identified the following significant results. All Skylab 2 imagery received to date has been analyzed manually and data related to fracture analysis and mined land inventories has been summarized on map-overlays. A comparison of the relative utility of the Skylab image products for fracture detection, soil tone/vegetation contrast mapping, and mined land mapping has been completed. Numerous fracture traces were detected on both color and black and white transparencies. Unique fracture trace data which will contribute to the investigator's mining hazards analysis were noted on the EREP imagery; these data could not be detected on ERTS-1 imagery or high altitude aircraft color infrared photography. Stream segments controlled by fractures or joint systems could be identified in more detail than with ERTS-1 imagery of comparable scale. ERTS-1 mine hazards products will be modified to demonstrate the value of this additional data. Skylab images were used successfully to update a mined land map of Indiana made in 1972. Changes in mined area as small as two acres can be identified. As the Energy Crisis increases the demand for coal, such demonstrations of the application of Skylab data to coal resources will take on new importance.

**N74-16049#** Geological Survey, Washington, D.C.

**CLASSIFICATION OF PUBLIC LANDS VALUABLE FOR GEOTHERMAL STEAM AND ASSOCIATED GEOTHERMAL RESOURCES**

L. H. Godwin, L. B. Haigler, R. L. Rioux, D. E. White, L. J. P. Muffler, and R. G. Wayland 1971 21 p refs (CIRC-647) Avail: NTIS HC \$3.25

The classification standards for determining which Federal lands are classifiable as geothermal steam and associated geothermal resources lands under the Geothermal Steam Act of 1970 (84 Stat. 1566) are presented. The concept of a geothermal resources province is established for classification of lands for the purpose of retention in Federal ownership of rights to geothermal resources upon disposal of Federal lands. A geothermal resources province is defined as an area in which higher than normal temperatures are likely to occur with depth and in which there is a reasonable possibility of finding reservoir rocks that will yield steam or heated fluids to wells. The determination of a known geothermal resources area is made after careful evaluation of the available geologic, geochemical, and geophysical data and any evidence derived from nearby discoveries, competitive interests, and other indicia. Author

**N74-16264#** Honeywell, Inc., Minneapolis, Minn. Systems and Research Center.

**APPLICATION AND DURABILITY OF SOLAR ABSORBER COATINGS** Final Report

R. E. Peterson and J. W. Ramsey Jul. 1973 50 p refs (Contract F33615-73-C-5074; AF Proj. 7380)

(AD-769449; Rept-2817-3001; AFML-TR-73-167) Avail: NTIS CSCL 11/3

The suitability of solar absorber coatings for use as the

thermal power source to drive spaceborne Vuilleumier cycle cryogenic refrigerators was evaluated. The coating tested consisted of layers of A12O3-Mo-A12O3 (AMA) on various substrates. The coating was thermally cycled from 1500 to 1600F about 10,000 times, simulating conditions for three years in orbit. Results are discussed. GRA

**N74-16332#** Bureau of Mines, Bartlesville, Okla. Energy Research Center.

**ALDEHYDE AND REACTIVE ORGANIC EMISSIONS FROM MOTOR VEHICLES. PART 1: ADVANCED AUTOMOTIVE CONTROL SYSTEMS VEHICLES** Final Report

Mar. 1973 92 p refs Sponsored by EPA  
(PB-224251/9GA; APTD-1568A-Pt-1) Avail: NTIS HC \$6.75 CSCI 13B

Aldehyde and reactive organic emissions as well as carbon monoxide and oxides of nitrogen emissions from automobiles equipped with various types of advanced prototype emission control systems including both catalytic and thermal reactor type systems were measured. The aim was to characterize aldehyde and reactive organic emissions from vehicles with prototype advanced emission control systems to provide data necessary to help determine if there is a need for aldehyde and/or reactive organic motor vehicle regulations, and to determine on a preliminary basis, the effect of ambient temperature on the emission characteristics of advanced emission control systems. (Modified author abstract) GRA

**N74-16333#** Bureau of Mines, Bartlesville, Okla. Energy Research Center.

**ALDEHYDE AND REACTIVE ORGANIC EMISSIONS FROM MOTOR VEHICLES. PART 2: CHARACTERIZATION OF EMISSIONS FROM 1970 THROUGH 1973 MODEL VEHICLES** Final Report

Mar. 1973 50 p refs Sponsored by EPA  
(PB-224252/7GA; APTD-1568B-Pt-2) Avail: NTIS HC \$4.50 CSCI 13B

Aldehyde and reactive organic emissions as well as carbon monoxide and oxides of nitrogen emissions were measured from 1970 through 1973 model vehicles. The aim was to characterize such emissions and to provide data to compare exhaust hydrocarbon reactivity for exhaust from 1970 through 1973 vehicles with that of exhaust from prototype low-emission systems. (Modified author abstract) GRA

**N74-16339#** Hittman Associates, Inc., Columbia, Md.  
**ASSESSMENT OF SO2 CONTROL ALTERNATIVES AND IMPLEMENTATION PATTERNS FOR THE ELECTRIC UTILITY INDUSTRY**

Mar. 1973 145 p refs  
(Contract OST-40)  
(PB-224119/8GA; HIT-550) Avail: NTIS HC \$4.50 CSCI 13B

Four cases were investigated with the computer model developed by Hittman Associates to determine the nature of implementation plans for sulfur oxide control at the regional and national levels. In 1975 demand for low sulfur fuels will have exceeded the available supply. The four cases studied will achieve compliance with the state and Federal emission regulations by 1986 (one by 1983). All are based on the timely development of solvent refined coal and the availability and utilization of alternative stack gas cleaning and control processes. Control alternatives are summarized and discussed including nuclear power and other advanced energy conversion systems such as hydroelectric and geothermal. GRA

**N74-16424#** Joint Publications Research Service, Arlington, Va.

**EXPERIMENTAL RESEARCH ON MODEL MHD GENERATOR U-02 (STAGE 2). SCIENTIFIC AND TECHNICAL REPORT 17/73**

11 Jan. 1974 305 p refs Transl. into ENGLISH of the book "Eksperimentalnyye Issledovaniya Modelnoy Energeticheskoy MGD Ustanovke U-02 (2 Etap). Nauchno-Tekhnicheskii Otchet

17/73" Moscow, May 1973 305 p  
(JPRS-60972) Avail: NTIS HC \$17.25

The basic results are presented of stage 2 of research on a model combined MHD power plant (the U-02 installation). The research was conducted in order to investigate the basic physical processes that take place in parts of the open-cycle MHD generator. Author

**N74-16483#** Pratt and Whitney Aircraft, West Palm Beach, Fla.

**INFLUENCE OF FUELS AND LUBRICANTS ON TURBINE ENGINE DESIGN AND PERFORMANCE, FUEL AND LUBRICANT ANALYSES** Final Technical Report, 30 Mar. 1971 - 30 Mar. 1973

Richard L. Bucknell Wright-Patterson AFB, Ohio AFAPL Jun. 1973 273 p

(Contract F33615-71-C-1470; AF Proj. 3048)  
(AD-769309; PWA-FR-5673; AFAPL-TR-73-52-Vol-2) Avail: NTIS CSCI 21/4

An analytical study was conducted to determine the requirements for future fuels and lubricants research based on design studies of a high Mach number afterburning turbojet and a higher Mach number advanced multicycle turboramjet. Fuel and lubrication systems were defined, and computer models were developed for their thermal analyses. Fuel and lubricant stream temperature profiles were computed, and the effects of design modifications on these temperatures were evaluated. Fuel and lubricant temperatures were calculated for baseline missions, for steady-state flight envelope points, for alternate aircraft/engine interface fuel temperatures, and for transient maneuvers. (Modified author abstract) GRA

**N74-16493#** General Electric Co., Cincinnati, Ohio. Flight Propulsion Div.

**HYDROGEN-METHANE FUEL CONTROL SYSTEMS FOR TURBOJET ENGINES** Final Report

J. S. Goldsmith and G. W. Bennett Oct. 1973 162 p refs  
(Contract NAS3-14319)

(NASA-CR-121247; R74AEG153; TM-73-489) Avail: NTIS HC \$10.25 CSCI 21E

Design, development, and test of a fuel conditioning and control system utilizing liquid methane (natural gas) and liquid hydrogen fuels for operation of a J85 jet engine were performed. The experimental program evaluated the stability and response of an engine fuel control employing liquid pumping of cryogenic fuels, gasification of the fuels at supercritical pressure, and gaseous metering and control. Acceptably stable and responsive control of the engine was demonstrated throughout the sea level power range for liquid gas fuel and up to 88 percent engine speed using liquid hydrogen fuel. Author

**N74-16513#** Little (Arthur D.), Inc., Cambridge, Mass. Engineering Sciences

**ENERGY CONSERVATION WITH SOLAR CLIMATE CONTROL**

Peter E. Glaser 14 Nov. 1973 9 p Presented to Subcomm. on Energy of the Comm. on Sci. and Astronaut., US House of Representatives, Washington, 14 Nov. 1973  
Avail: NTIS HC \$3.00

The use of solar energy for climate control is discussed, with emphasis on solar heating and cooling of buildings. Government/industry relations are discussed in terms of taking action and supplying the market for solar climate control systems. The components of these systems are listed. K.M.M.

**N74-16514#** Little (Arthur D.), Inc., Cambridge, Mass.

**A NEW VIEW OF SOLAR ENERGY**

Peter E. Glaser and James E. Murphy 1971 12 p refs Presented at Intersoc. Energy Conversion Eng. Conf., Boston, 3-6 Aug. 1971

Avail: NTIS HC \$3.00

The use of solar energy as a comprehensive national energy policy is discussed in terms of its social, economic, and environmental effects. Also considered are the nature of solar energy, practical considerations, and research needs. K.M.M.

**N74-16620#** Bureau of Mines, Pittsburgh, Pa. Energy Research Center.

**AN ECONOMIC EVALUATION OF MHD-STEAM POWER-PLANTS EMPLOYING COAL GASIFICATION**

P. D. Bergman, K. D. Plants, J. J. Demeter, and D. Bienstock  
1973 37 p refs  
(BM-RI-7796) Avail: NTIS HC \$4.00

To assess the efficacy and economics of producing power from coal, four open-cycle magnetohydrodynamic (MHD) processing schemes were selected for study. Each involved a different mode of coal combustion and level of gas cleanliness. The options considered were: (1) coal burned in a slagging combustor; (2) suspension gasification with slag removal prior to combustion; (3) parallel cyclone combustors, one operating fuel rich and the other operating with excess air; and (4) suspension gasification by the hot exhaust gases from the MHD duct with ash removed prior to combustion. Option 1 has the highest ash content in the combustion plasma and as a result would have the greatest operational difficulties associated with it. Options 2 and 4 have the cleanest MHD combustion plasma. For coal priced at \$4/ton, the power generating cost of Option 4, 11.78 mills/kW-hr, is the highest, with Option 1, at 9.04 mills/kW-hr the lowest. These costs may be compared with a conventional power cost of 9.92 mills/kW-hr for the late seventies. Capital costs of three of the four options were competitive with those of conventional thermal power plants employing stack gas SO<sub>2</sub> cleanup systems. Option 2 has the most favorable combination of operating characteristics and power cost. It was concluded that a clean, high-temperature working fluid can probably be produced from coal without leading to depressed system efficiencies and exorbitant capital cost.

Author

**N74-16627#** National Environmental Research Center, Research Triangle Park, N.C. Control Systems Lab.

**PROCEEDINGS, COAL COMBUSTION SEMINAR**

Robert E. Hall and David W. Pershing. Sep. 1973 305 p refs  
Seminar held at Res. Triangle Park, N. C. 19-20 Jun. 1973  
(PB-224210/5GA; EPA-650/2-73-021) Avail: NTIS  
HC \$7.00 CSCL 21B

The proceedings document the 10 presentations made during the Seminar, which dealt with subjects related to EPA's research and development activities for control of air pollutant emissions from the combustion of pulverized coal. The Seminar was divided in two parts: participating in the portion on fundamental research were Rockwell International's Rocketdyne Division, KVB Engineering, Inc. and Southern California Edison Co., EPA Holland's International Flame Research Foundation, and Jet Propulsion Laboratory; and taking part in the portion on pilot- and full-scale tests were Babcock and Wilcox (Alliance Research Center), U.S. Bureau of Mines, Esso Research and Engineering Co., Combustion Engineering, Inc., and Tennessee Valley Authority. Purpose of the Seminar was to provide contractors and industrial representatives with the latest information on coal combustion research.

GRA

**N74-16641** Committee on Interior and Insular Affairs (U. S. Senate).

**A BIBLIOGRAPHY OF NON-TECHNICAL LITERATURE ON ENERGY**

Flora Dean, comp. Washington GPO 1971 104 p refs  
Presented to Comm. on Interior and Insular Affairs, 92d Congr., 1st Sess., 5 Nov. 1971 Prepared by Library of Congr.  
Avail: Comm. on Interior and Insular Affairs

A bibliography of non-technical literature on energy sources and problems was prepared for the Committee on Interior and Insular Affairs of the United States Senate. The reports cover the period of time from 1 July 1969 to 1 July 1971. The subjects covered include the following: (1) national energy goals, (2) energy policy issues, (3) projections for future demands, (4) resource base for all energy sources, (5) management of federally owned resources, (6) production of fuels, (7) transportation of energy and fuels, (8) utilization (including conservation measures), and (9) environmental effects (relation of environmental policy to energy policy). P.N.F.

**N74-16642** Committee on Interior and Insular Affairs (U. S. Senate).

**A BIBLIOGRAPHY OF CONGRESSIONAL PUBLICATIONS ON ENERGY FROM THE 89TH CONGRESS TO 1 JULY 1971**

Dana C. Ellingen, comp. and William E. Towsey, Jr., comp. Washington GPO 1971 63 p refs Presented to Comm. on Interior and Insular Affairs, 92d Congr., 1st Sess., 5 Nov. 1971  
Avail: Comm. on Interior and Insular Affairs

A bibliography of Congressional Publications on Energy Resources and Requirements is presented. The documents cover the period of time from 1 January 1965 to 30 June, 1969. The subjects included in the bibliography are: (1) national energy goals, (2) energy policy issues, (3) projections of future demands, (4) resource base for all types of energy sources, (5) management of federally owned resources, (6) production of fuels (including storage), (7) transportation of energy and fuels, (8) utilization (including conservation measures), (9) environmental effects, (10) research and development of resources, and (11) changing and improving regulatory practices. P.N.F.

**N74-16651#** Denver Univ., Colo. Petroleum Economics Inst.  
**BALANCING SUPPLY AND DEMAND FOR ENERGY IN THE UNITED STATES**

1972 166 p refs  
Avail: NTIS HC \$10.50

The proceedings of a conference on the problem of balancing supply and demand for energy in the United States are presented. The time span considered is from 1972 to 1985. The subjects discussed are: (1) U.S. energy demands based on population and economic growth, (2) government policies, national objectives, and the energy industries, (3) long run cost trends for energy sources, and (4) supply and demand aspects of oil, natural gas, coal, electricity, nuclear fuels, and other energy forms. One paper is directed toward the environmental protection and long run supply of crude oil in the United States. For individual titles, see N74-16652 through N74-16661.

**N74-16652** Gonzalez (Richard J.), Houston, Tex.  
**FUTURE UNITED STATES POPULATION, ECONOMIC GROWTH, AND ENERGY DEMANDS**

Richard J. Gonzalez /in Denver Univ. Balancing Supply and Demand for Energy in the US 1972 p 1-8

The impact of United States population and economic growth on energy demands is discussed. The need for reasonably rational analyses based on correct information and on realistic assumptions with respect to the future energy requirements is stressed. The subjects considered are: (1) the outlook for U.S. population, (2) the potential for U.S. economic growth, (3) probable U.S. energy requirements, and (4) perspective on long term energy problems. The author concludes that the future welfare of mankind requires that energy problems receive the best possible rational study as the basis for intelligent decisions about all policies and actions that affect energy availability, cost, and use. Author

**N74-16653** Stanford Research Inst., Menlo Park, Calif. Energy and Resources Economics.

**GOVERNMENT, POLICIES, NATIONAL OBJECTIVES, AND THE ENERGY INDUSTRIES**

Sherman H. Clark /in Denver Univ. Balancing Supply and Demand for Energy in the US 1972 p 9-27 refs

The requirements for the development of a national policy on energy sources and utilization are discussed. The economic factors which influence the availability of natural gas and petroleum are analyzed. The impact of energy availability on the national goals of economic growth and employment is examined. The most immediate issues to be resolved are identified as oil and gas pricing and the security of the supply of these resources. Tables of data are included to show: (1) free world oil production from 1970 to 1990, (2) energy demands and oil imports from oil producing and exporting countries, (3) the importance of offshore oil imports, and (4) U.S. energy consumption patterns for 1968. Author

**N74-16654** First National City Bank, New York.  
**CAPITAL REQUIREMENTS OF THE ENERGY INDUSTRIES**  
 Edward Symonds *In* Denver Univ. Balancing Supply and Demand  
 for Energy in the US 1972 p 29-37

The economic factors which influence the investments which should be made in developing natural resources for energy purposes are discussed. Capital outlays for the energy industries of the U.S. involving electricity, oil, gas and other are tabulated for 1970 and estimated for 1980. A similar tabulation is presented for nations of the non-Communist world. Energy demands for the U.S. and non-Communist countries from 1960 to 1980 are analyzed. Factors, other than economic which influence the amounts and types of energy available are examined. Author

**N74-16655** Massachusetts Inst. of Tech., Cambridge. Dept. of Economics.

**LONG RUN COST TRENDS: PERSIAN GULF AND UNITED STATES**

M. A. Adelman *In* Denver Univ. Balancing Supply and Demand for Energy in the US 1972 p 39-72 refs

The production costs of crude oil and natural gas in the U.S. are compared with those for the Persian Gulf nations. A theory of petroleum production costs is presented to show the relationship between production, development, and exploration of petroleum supplies. The effect of changing sources of reserves on the development costs of new petroleum resources is analyzed. The expected supply from the North Shore Alaska petroleum field is reported. Tables of data are included to show the following: (1) development investment in Persian Gulf petroleum, (2) cost projection of Persian Gulf resources from 1965 to 1969, (3) exploration activity and expenditures in North American petroleum development from 1955 to 1970, and (4) significant discoveries of oil and gas from 1945 to 1964. Author

**N74-16656** Texas Univ., Austin. College of Social and Behavioral Sciences.

**BALANCING THE DEMAND AND SUPPLY OF OIL**

James W. McKie *In* Denver Univ. Balancing Supply and Demand for Energy in the US 1972 p 73-90 refs

The economic factors which influence the supply and demand of crude oil in the U.S. are discussed. Estimates are made of the projected availability of petroleum from domestic sources through the year 1980. The availability of petroleum supplies based on the predictions of exploration and development is analyzed. Tables of data are provided to show the following: (1) projections of the oil supply-demand balance from 1980 to 1985, and (2) estimates of domestic U.S. production in 1975, 1980, and 1985. The need for a Federal energy policy is stressed and approaches to such a policy are submitted. Author

**N74-16657** North Carolina State Univ., Raleigh.

**BALANCING THE SUPPLY AND DEMAND FOR NATURAL GAS**

Edward W. Erickson and Robert M. Spann *In* Denver Univ. Balancing Supply and Demand for Energy in the US 1972 p 91-106 refs

An analysis of the supply and demand factors involving natural gas as an energy source was conducted. The need for a workable policy for natural gas production and use is stressed. Factors which have contributed to the lessening supply are reported. Measures for improving the situation are proposed. Tables of data are included to show: (1) predicted and actual discoveries of crude oil and natural gas from 1953 to 1967, (2) trends in well head price of natural gas compared with quantity of natural gas discoveries, (3) effects of oil and gas prices and other variables on oil and gas discoveries, and (4) projections of non-associated natural gas prices and required discoveries for the period of 1972 to 1985. Author

**N74-16658** Peabody Coal Co., St. Louis, Mo.

**BALANCING THE DEMAND AND SUPPLY OF COAL**

Thomas M. Lydon *In* Denver Univ. Balancing Supply and Demand

for Energy in the US 1972 p 107-114

An analysis of coal supplies for energy applications was conducted to determine methods of obtaining a balance between supply and demand. The problems faced by the coal producer and those of the coal user are examined to show the environmental impacts. Methods for meeting the energy shortages through improved coal utilization are proposed. A table is included to show the total demand for U.S. coal (including exports). Author

**N74-16659** Kerr-McGee Corp., Oklahoma City.

**BALANCING THE DEMAND AND SUPPLY OF ELECTRICITY AND NUCLEAR FUELS**

Dean A. McGee *In* Denver Univ. Balancing Supply and Demand for Energy in the US 1972 p 115-130 refs

The problem of obtaining a balance between demand and supply of nuclear fuel for electric power generation in the United States to 1985 is discussed. It is stated that the balance will depend on economic rather than geologic considerations. Proven reserves of uranium and the quality of the resource base that offers potential for new discoveries assure that uranium ore deposits available for development and production will be sufficient to meet demand. Projections are made in the growth of the nuclear powered electric energy field. The operation of the nuclear reactors and the nuclear fuel cycle involved in electric power production are described. Charts are included to show the projected utilization of nuclear fuels and the mix of coal, hydro, gas, thermal, and nuclear fuels to the year 2000. Author

**N74-16660** Sun Oil Co., Philadelphia, Pa. Economics and Industry Affairs.

**BALANCING THE DEMAND AND SUPPLY OF OTHER ENERGY FORMS**

James S. Cross *In* Denver Univ. Balancing Supply and Demand for Energy in the US 1972 p 131-143

Methods for balancing the demand and supply of various energy forms are discussed. A graphic presentation of the U.S. energy balance for the five year periods beginning in 1970 and extending to 1985 is developed. The economic and environmental factors involved in using hydroelectric, geothermal, synthetic gas, and tar sands for energy sources are examined. Other sources of energy from agricultural products and tidal energy are analyzed. The potential for using more of the energy available from the sun is proposed. Author

**N74-16661** Texas Univ., Austin.

**ENVIRONMENTAL PROTECTION AND LONG RUN SUPPLY OF CRUDE OIL IN THE UNITED STATES**

Stephen L. McDonald *In* Denver Univ. Balancing Supply and Demand for Energy in the US 1972 p 145-158 refs

A study was conducted to determine the effects of energy conversion on the environment. The effects of various types of energy sources were examined and examples of legislation to reduce environmental pollution are presented. The subjects discussed are: (1) protection of the environment and national income, (2) allocation of environmental protection costs, (3) environmental protection problems in the petroleum industry, and (4) progress in developing new environmental protection techniques. Author

**N74-16662#** Committee on Interior and Insular Affairs (U. S. Senate).

**ENERGY EMERGENCY LEGISLATION, PART 1**

Washington: GPO 1973 364 p refs Hearing on S. 2589 before Comm. on Interior and Insular Affairs, 93d Congr., 1st Sess., 8 Nov. 1973  
 Avail: SOD HC \$2.35

A Congressional hearing concerning emergency energy legislation was conducted. The purpose of the legislation was as follows: (1) to declare by congressional action a nationwide energy emergency, (2) to authorize the president to immediately undertake specific actions to conserve scarce fuels and increase

supply, (3) to initiate the development of local, state, national, and international contingency plans, and (4) to assure the continuation of vital public services. P.N.F.

**N74-16664#** Committee on Interior and Insular Affairs (U. S. Senate).

**FUEL SHORTAGES, PART 1**

Washington GPO 1973 530 p refs Hearings before Comm. on Interior and Insular Affairs, 93d Congr., 1st Sess., 1 Feb. 1973 2 Vol.

Avail: Comm. on Interior and Insular Affairs

A Congressional hearing was conducted to investigate the factors contributing to current shortages of natural gas, residual oil, and other refined products. Testimony from the Senators of various states is submitted to show the extent of the energy crisis and their understanding of the basic causes. Communications from various segments of the economy are included to define the scope of the shortages and the impact on industry, public utilities, and home use. Tables of data are developed to show the resources available and the anticipated problem areas. The actions to be taken by Federal organizations to improve the energy situation are recommended. P.N.F.

**N74-16665#** Committee on Interior and Insular Affairs (U. S. Senate).

**FUEL SHORTAGES, PART 2**

Washington GPO 1973 270 p refs Hearings before Comm. on Interior and Insular Affairs, 93d Congr., 1st Sess., 22 Feb. 1973 2 Vol.

Avail: Comm. on Interior and Insular Affairs, 93d Congr., 1st Sess., 22 Feb. 1973

**N74-16666#** Committee on Interior and Insular Affairs (U. S. Senate).

**THE EVOLUTION AND DYNAMICS OF NATIONAL GOALS IN THE UNITED STATES**

Franklin P. Huddle Washington GPO 1971 66 p refs Presented to Comm. on Interior and Insular Affairs, 92d Congr., 1st Sess., 16 Aug. 1971 Prepared by Library of Congr.

Avail: Comm. on Interior and Insular Affairs

A Congressional hearing was conducted to examine the evolution and dynamics of the National Goals in the U.S. The study reviews the history of national goal formation beginning with the Preamble to the Constitution of the United States. The process and specifics of national goal formation during several administrations are described. The background information provided by the study is considered useful in identifying the role of the energy policy in the implementation of national goals. The subjects contained in the study are: (1) historical evolution of the goals of the U.S., (2) maturation of early constitutional goals, (3) succession of national goals in the past half-century, (4) the interaction of science and technology with national goals, and (5) recent attempts to chart new goals for America. P.N.F.

**N74-16667#** Committee on Interior and Insular Affairs (U. S. Senate).

**A REVIEW OF ENERGY ISSUES AND THE 91ST CONGRESS**

Washington GPO 29 Jan. 1971 41 p refs Presented to Comm. on Interior and Insular Affairs, 92d Congr., 1st Sess., 15 Dec. 1970 Prepared by Library of Congr.

Avail: Comm. on Interior and Insular Affairs

A review of the energy crisis issues considered by the U.S. Congress was conducted. The purpose of the review is to examine the interrelationships between energy supply, the environment, resource conservation, economic growth, and the attainment of important national goals. The policy issues in the energy field involve the following: (1) oil imports, (2) trans-Alaska pipeline, (3) outer continental shelf, (4) natural gas supply, (5) shortages and movement toward an overall energy policy, (6) electric power generation and transmission, and (7) nuclear energy development and environmental effects. P.N.F.

**N74-16668#** Committee on Interior and Insular Affairs (U. S. Senate).

**COMPACT TO CONSERVE OIL AND GAS**

Washington GPO 1971 30 p Hearing on S. J. Res. 72 before Comm. on Interior and Insular Affairs, 93d Congr., 1st Sess., 17 Jun. 1971

Avail: Subcomm. on Minerals and Fuels

A Congressional hearing concerning an extension of the Interstate Compact to Conserve Oil and Gas was conducted. The purpose of the compact is to prevent physical waste of natural resources within the states which ratify the compact. The states are expected to accomplish the legislation to prevent the following: (1) operation of any oil well with an inefficient gas-oil ratio, (2) drowning with water of any stratum capable of producing oil or gas, or both oil and gas, in paying quantities, (3) avoidable escape into the open air or the wasteful burning of gas from a natural gas well, (4) the creation of unnecessary fire hazards, (5) the drilling, equipping, locating, spacing, or operating a well or wells so as to bring about physical waste of oil or gas, and (6) the inefficient, excessive, or improper use of reservoir energy in producing wells. Author

**N74-16669#** Committee on Interior and Insular Affairs (U. S. Senate).

**FEDERAL ENERGY ORGANIZATION: A STAFF ANALYSIS**

Washington GPO 1973 66 p refs Presented to Comm. on Interior and Insular Affairs, 93d Congr., 1st Sess., 5 Mar. 1973

Avail: Comm. on Interior and Insular Affairs

A Congressional staff analysis was prepared to provide information on the significance of energy organization and the present organization structure for handling energy matters. A history of the Federal Energy Organization is provided and the functions in various areas of resources management are defined. The deficiencies in existing Federal Energy Organizations are analyzed. A tabulation of the Federal Energy Agencies is provided. Summaries of proposed Federal reorganization for energy are developed. P.N.F.

**N74-16670#** Committee on Interior and Insular Affairs (U. S. Senate).

**GEOTHERMAL ENERGY RESOURCES AND RESEARCH**

Washington GPO 1972 472 p refs Hearings before Comm. on Interior and Insular Affairs, 92d Congr., 2d Sess., 15 and 22 Jun. 1972

Avail: SOD HC \$2.75

A Congressional hearing was conducted to discuss the role of geothermal energy resources in the nation's economy. The proposed costs of research and development projects for geothermal energy exploitation are discussed. The research projects to be conducted are defined. Information is provided on the subjects of: (1) assessment of geothermal energy resources, (2) a theoretical study of geothermal energy extraction, (3) classification of public lands valuable geothermal steam and associated geothermal resources, and (4) environmental impact statement for the geothermal leasing program. P.N.F.

**N74-16673#** RAND Corp., Santa Monica, Calif.

**A METHODOLOGY FOR PROJECTING THE ELECTRICAL ENERGY DEMAND OF THE MANUFACTURING SECTOR IN CALIFORNIA**

W. E. Mooz and C. C. Mow Jan. 1973 75 p refs (Grant NSF GI-44)

(R-991-NSF/CSRA) Avail: NTIS HC \$5.75

The methodology reported is one part of a total electrical energy demand estimating methodology developed for use in California. Separate methodologies were developed for each sector of the economy, which comprises the following: residential; industrial (consisting of manufacturing and mining); commercial; governmental; and agricultural. In place of quantitative, determinant-based relationships, the methodology described relies on the projection of individual trends in electrical energy use for each of 20 manufacturing industries identified by the Standard Industrial Code. Data on these trends are presented, and reasonable projections are suggested. In addition, the roles of each of the determinants of electrical energy use are explored qualitatively.

for the benefit of analysts required to apply judgment in selecting inputs for the methodology. Author

**N74-16674# RAND Corp., Santa Monica, Calif.  
FUEL FROM ORGANIC MATTER: POSSIBILITIES FOR THE  
STATE OF CALIFORNIA**

Doris J. Dugas Oct. 1973 19 p refs  
(P-5107) Avail: NTIS HC \$3.00

The amounts of organic material that might be made available for energy purposes in the State of California, its potential fuel value, and the estimated cost are investigated. Sources of organic material that are considered are: (1) crops grown specifically for energy, (2) natural forests, and (3) wastes from the urban, agricultural, and industrial sectors. Preliminary results indicate that about 19 percent of California's gas supply could be derived from organic sources. Author

**N74-16675# RAND Corp., Santa Monica, Calif.  
THE SOVIET UNION, THE MIDDLE EAST, AND THE  
EVOLVING WORLD ENERGY SITUATION**

Arnold L. Horelick Oct. 1973 10 p ref Presented at Conf. on Choices for Europe and Am. The Middle East and the Energy Situation, 1973-1985, Ditchley Park, Engl.; sponsored by Ditchley Found., Intern. Inst. for Strategic Studies, Middle East Inst., and the World Peace Found.  
(P-5109) Avail: NTIS HC \$3.00

The U.S.S.R.'s position on the world oil crisis is discussed with special attention given to the limits of Soviet influence in global politics and a Soviet-preferred future world energy scenario. K.M.M.

**N74-16676# RAND Corp., Santa Monica, Calif.  
MEASURES FOR SLOWING GROWTH IN ELECTRICITY  
CONSUMPTION**

Ronald D. Doctor Apr. 1973 16 p refs Presented at Hearing of Subcomm. on State Elec. Energy Policy of Calif. State Assembly Comm. on Planning and Land Use, Sacramento, 23 Feb. 1973 Sponsored by NSF  
(P-5017) Avail: NTIS HC \$3.00

Methods for reducing the growth rate of electricity demand are examined. The greatest opportunities for slowing growth were found in the residential and commercial sectors. Measures for conserving energy are presented, such as improved insulation, solar energy, gas substitution, increased air conditioning efficiency, decreased electricity for lighting, and low energy buildings. J.A.M.

**N74-16677# RAND Corp., Santa Monica, Calif.  
ENERGY CONSERVATION IN PUBLIC AND COMMERCIAL  
BUILDINGS**

Richard G. Salter and Deane N. Morris Oct. 1973 61 p  
Sponsored by NSF  
(P-5093) Avail: NTIS HC \$5.25

A discussion is presented of the preliminary results of an ongoing study of the use of energy in public and commercial buildings. The effects of building location, design and operation alternatives are developed, together with initial estimates of the conservation potential in the sector. Author

**N74-16679# RAND Corp., Santa Monica, Calif.  
A METHODOLOGY FOR PROJECTING THE ELECTRICAL  
ENERGY DEMAND OF THE COMMERCIAL SECTOR IN  
CALIFORNIA**

W. E. Mooz and C. C. Mow Mar. 1973 46 p refs  
(Grant NSF GI-44)  
(R-1106-NSF/CSRA) Avail: NTIS HC \$4.50

Methodology was developed for the electrical energy demand of commercial sectors, mining portion of the industrial sector, and other small sectors of California economy. Methodologies were based upon the output of the sector, measured in terms of dollars of value added or dollars of contributed to gross state product; on the electrical energy intensiveness of the sector; and upon the price of electricity and natural gas. In small sectors, such as agriculture and railroads, the use of electricity was found to be either constant or the result of fairly simple forces. J.A.M.

**N74-16680# RAND Corp., Santa Monica, Calif.  
CALIFORNIA'S ELECTRICITY QUANDARY. 3: SLOWING  
THE GROWTH RATE**

R. D. Doctor, K. P. Anderson, M. B. Berman, S. H. Dole, M. J. Hammer, P. T. McClure, and C. B. Smith Sep. 1972 158 p refs  
(Grant NSF GI-44)

(R-1116-NSF/CSA) Avail: NTIS HC \$10.00

Results are presented of one part of a broad study effort on the underlying cause of the conflict between energy and the environment-the rapid increase in demand for energy in all its forms-and on the implications of this conflict for governmental policymaking. The objectives are: (1) to examine the need for new state policies that would slow the growth of electricity demand; (2) to estimate the potential effectiveness of policies designed to slow the growth rate; and (3) to evaluate the potentially important side effects of slowed electricity growth. Author

**N74-16684# Committee on Science and Astronautics (U. S.  
House).**

**GEOTHERMAL ENERGY**

Washington GPO 1973 390 p refs Hearings on HR. 8628 and H.R. 9658 before Comm. on Sci. and Astronaut., 93d Congr., 1st Sess., No. 21, 11, 13, and 18 Sep. 1973  
Avail: Subcomm. on Energy

The hearings are reported concerning the economic and technological feasibility of developing geothermal energy sources. Two bills are presented and discussed which would establish a Geothermal Energy Development Corporation to construct two or more geothermal demonstration installations and to develop alternate technology for generating steam and electric power from geothermal sources. Other topics include: the state of geothermal energy technology; environmental problems; the status of R and D activities; and international and foreign policy considerations. K.M.M.

**N74-16690# Massachusetts Inst. of Tech., Cambridge. Energy  
Lab.**

**MODELING OF ELECTRIC POWER DEMAND GROWTH  
Final Report**

J. B. Woodard, Jr., M. L. Baughman, and F. C. Schweppe Feb. 1973 20 p refs Presented at MIT Conf. on Energy: Demand, Conservation and Institutional Probl., 12-15 Feb. 1973  
(Grant NSF GI-32874)

(PB-224045/5GA; MIT-EL-73-015) Avail: NTIS HC \$3.00  
CSCL 10B

The paper describes a modeling approach, presently under development, directed at the growth in demand for electric power. The emphasis is to develop a mathematical model which can be used for the analysis of detailed questions, such as: How will changes in air conditioning power demand, electric rate structures, population, etc., affect the daily load shapes (MW vs time) as well as the peak power and the overall electric energy consumption. Detailed answers to these questions are needed for generation planning of capacity and plant mix (nuclear, fossil, and pumped-hydro) as well as for the evaluation of the resulting environmental and economic impacts. These issues require detailed models combining economic models with engineering considerations affecting the dynamics of load behavior. Modeling of this kind can be limited by the data available, and an important aspect of this effort is to identify the data required for a detailed understanding of the load. The approach to be employed is a combination of state dynamic models driven by stochastic processes with economic models. GRA

**N74-16691# Army War Coll., Carlisle Barracks, Pa.  
UNITED STATES PETROLEUM SITUATION THROUGH  
1980**

Robert W. Huebner 14 Mar. 1973 54 p refs  
(AD-781576) Avail: NTIS CSCL 10/2

The current and projected United States petroleum and natural gas requirements through 1980 are examined. These two resources account for three-fourths of all the energy consumed in the United States. The unprecedented rate at which they are being consumed has caused an imbalance between demand and

supply and presents the Nation with an energy problem of serious and growing proportions. Domestic production is now unable to supply the needs of some consumer sectors and shortages of certain fuels exist. During the next three to five years, a further deterioration of the domestic supply position is anticipated and a sharp increase in imports is projected. The long lead times required to provide new domestic supplies make this development virtually certain. The United States also faces a serious balance of trade deficit as a result of our growing need for imports. In short, our petroleum position will become more severe in the longer term if present trends and policies continue.

Author (GRA)

**N74-16697#** Army War Coll., Carlisle Barracks, Pa.  
**THE US ENERGY CRISIS, THE MULTINATIONAL OIL CORPORATIONS AND THEIR RELATIONSHIP TO U.S. FOREIGN POLICY IN THE MIDDLE EAST**

John G. Pappageorge 28 Feb. 1973 59 p refs  
 (AD-760868) Avail: NTIS CSCL 05/3

America's current energy crisis consists of a growing dependence on foreign oil brought about by a continuing diminution in known domestic petroleum reserves and aggravated by a host of domestic anomalies that cry out for some sort of unified energy policy. Yet any steps taken domestically will have far reaching international effects, particularly in the Middle East. Eight giant corporations (five of them American) discover and pump most of the oil out of the ground in the producing countries. Hence, they have a powerful influence in the Middle East and are a contributing factor in the stability of that politically volatile part of the world.

Modified author abstract (GRA)

**N74-16756#** Linguistic Systems, Inc., Cambridge, Mass.

**EXPLOITATION OF WIND ENERGY**

Hans Christaller Washington NASA Feb. 1974 12 p refs  
 Transl. into ENGLISH from Elektrizitaetswirtschaft (West Germany), v. 50, no. 11, Nov. 1951 p 320-322  
 (Contract NASw-2482)  
 (NASA-TT-F-15309) Avail: NTIS HC \$3.00 CSCL 10B

The utilization of wind power is discussed. A measurement is made of the energy available from air currents. Wind turbulence is calculated together with the average power. The structural features of windmills are discussed in relation to possible industrial applications.

Author

**N74-16757#** National Aeronautics and Space Administration.  
 Lewis Research Center, Cleveland, Ohio.

**WIND ENERGY CONVERSION SYSTEMS**

Joseph M. Savino, ed. Dec. 1973 270 p refs Workshop  
 Proc. held at Washington, D. C., 11-13 Jun. 1973  
 (Grant NSF AG-465)  
 (NASA-TM-X-69786; NSF/RA/W-73-006) Avail: NTIS  
 HC \$15.50 CSCL 10B

Economic feasibilities and energy conversion efficiencies are considered for various alternative energy sources that utilize wind forces. For individual titles, see N74-16758 through N74-16799.

**N74-16758\*** Allis-Chalmers Mfg. Co., York, Pa.

**SMITH-PUTNAM WIND TURBINE EXPERIMENT**

Beauchamp E. Smith In NASA. Lewis Res. Center Wind  
 Energy Conversion Systems Dec. 1973 p 5-7

**CSCL 10B**

A brief outline of the many problems encountered during testing of a wind turbine generator prototype unit is given. Its feasibility was demonstrated by the generation of electricity in commercial quantities with delivery to a utility transmission network. The experiment was terminated after blade failure occurred.

G.G.

**N74-16759\*** Allis-Chalmers Mfg. Co., York, Pa.  
**MOTION PICTURE HISTORY OF THE ERECTION AND OPERATION OF THE SMITH-PUTNAM WIND GENERATOR**

Carl Wilcox In NASA. Lewis Res. Center Wind Energy Conversion  
 Systems Dec. 1973 p 8-10

**CSCL 10B**

A color movie presentation is discussed that presents the various stages in assembling the major subsystems of a synchronous wind generator, such as installing the rotor blades and the rotating platform at the top of the tower. In addition scenes are shown of the wind generator in operation. Author

**N74-16760\*** Federal Power Commission, Washington, D.C.

**PERCY THOMAS WIND GENERATOR DESIGNS**

Charles W. Lines In NASA. Lewis Res. Center Wind Energy  
 Conversion Systems Dec. 1973 p 11-18

**CSCL 10B**

The technical and economic feasibilities of constructing a windpowered generator with a capacity of 2,000 to 4,000 kilowatt are considered. Possible benefits of an integrated wind generating electric energy source in an electric utility network are elaborated. Applications of a windpowered waterpump, including its use as a pumping source for hydroelectric pump storage operations, are also mentioned. It is concluded that the greatest potential of the wind generator is to generate heat directly and not conversion to electricity and then to heat.

G.G.

**N74-16761\*** Stuttgart Univ. (West Germany).

**PAST DEVELOPMENTS OF LARGE WIND GENERATORS IN EUROPE**

Ulrich Hutter In NASA. Lewis Res. Center Wind Energy  
 Conversion Systems Dec. 1973 p 19-22

**CSCL 10B**

Physical size, maximum power output, and other characteristics of various windpower systems are shown in picture form.

G.G.

**N74-16762\*** Tompkin (Joseph), Salem, Ore.

**INTRODUCTION TO VOIGT'S WIND POWER PLANT**

Joseph Tompkin In NASA. Lewis Res. Center Wind Energy  
 Conversion Systems Dec. 1973 p 23-26

**CSCL 10B**

The design and operation of a 100 kilowatt wind driven generator are reported. Its high speed three-bladed turbine operates at a height of 50 meters. Blades are rigidly connected to the hub and turbine revolutions change linearly with wind velocity, maintaining a constant speed ratio of blade tip velocity to wind velocity over the full predetermined wind range. Three generators installed in the gondola generate either dc or ac current. Based on local wind conditions, the device has a maximum output of 720 kilowatts at a wind velocity of 16 meters per second. Total electrical capacity is 750 kilowatts, and power output per year is 2,135,000 kilowatt/hours.

G.G.

**N74-16763\*** National Aeronautics and Space Administration.  
 Lewis Research Center, Cleveland, Ohio.

**WHERE THERE IS A WIND, THERE IS A WAY**

Charles A. Mosher In its Wind Energy Conversion Systems  
 Dec. 1973 p 27-32

**CSCL 10B**

A shift in USA energy policy from oil or natural gases to thermonuclear fission and solar energy is predicted. A massive diversified energy research and development effort to productively harness the energy in the winds is outlined to develop commercially feasible wind energy conversion systems - considered a form of solar energy - in the near future.

G.G.

**N74-16764\*** West Texas State Univ., Canyon.

**NEED FOR A REGIONAL WIND SURVEY**

Vaughn Nelson and Earl Gilmore (Amarillo Coll.) In NASA.  
 Lewis Res. Center Wind Energy Conversion Systems Dec.  
 1973 p 33-40

**CSCL 10B**

Accurate measurements for the purpose of estimating wind energies are proposed in those regions of the USA where the greatest potentials exists. Preliminary wind characteristic calculations from weather station data are provided for the

Southern Great Plains region; wind energies from 153 to 212 kW-hr/(ft squared-per year) for 1970 to 1972 are determined. It is concluded that a wind energy survey based on data compiled from weather service stations is feasible for determining the energy potential of a windpowered integrated energy network.  
G.G.

**N74-16765\* Oklahoma Univ., Norman.  
WIND POWER DEMONSTRATION AND SITING PROBLEMS**

Karl H. Bergey *In* NASA. Lewis Res. Center Wind Energy Conversion Systems Dec. 1973 p 41-45 refs

**CSCL 10B**

Technical and economic feasibility studies on a small windmill to provide overnight charging for an electrically driven car are reported. The auxiliary generator provides power for heating and cooling the vehicle which runs for 25 miles on battery power alone, and for 50 miles with the onboard charger operating. The blades for this windmill have a diameter of 12 feet and are coupled through to a conventional automobile alternator so that they are able to completely recharge car batteries in 8 hours. Optimization of a windmill/storage system requires detailed wind velocity information which permits rational siting of wind power system stations.  
G.G.

**N74-16766\* Alaska Univ., Fairbanks.  
SURFACE WIND CHARACTERISTICS OF SOME ALEUTIAN ISLANDS**

Tunis Wentink, Jr. *In* NASA. Lewis Res. Center Wind Energy Conversion Systems Dec. 1973 p 46-52 refs

**CSCL 04B**

The wind power potential of Alaska is assessed in order to determine promising windpower sites for construction of wind machines and for shipment of wind derived energy. Analyses of near surface wind data from promising Aleutian sites accessible by ocean transport indicate probable velocity regimes and also present deficiencies in available data. It is shown that winds for some degree of power generation are available 77 percent of the time in the Aleutians with peak velocities depending on location.  
G.G.

**N74-16767\* Oregon State Univ., Corvallis.  
WIND POWER RESEARCH AT OREGON STATE UNIVERSITY**

E. Wendell Hewson *In* NASA. Lewis Res. Center Wind Energy Conversion Systems Dec. 1973 p 53-61 refs

**CSCL 10B**

There have been two primary thrusts of the research effort to date, along with several supplementary ones. One primary area has been an investigation of the wind fields along coastal areas of the Pacific Northwest, not only at the shoreline but also for a number of miles inland and offshore as well. Estimates have been made of the influence of the wind turbulence as measured at coastal sites in modifying the predicted dependence of power generated on the cube of the wind speed. Wind flow patterns in the Columbia River valley have also been studied. The second primary thrust has been to substantially modify and improve an existing wind tunnel to permit the build up of a boundary layer in which various model studies will be conducted. One of the secondary studies involved estimating the cost of building an aerogenerator.  
Author

**N74-16768\* Electrical Research Association, Surrey (England).  
WIND DATA FOR WIND DRIVEN PLANT**  
Arthur H. Stodhart *In* NASA. Lewis Res. Center Wind Energy Conversion Systems Dec. 1973 p 62-69

**CSCL 04B**

Simple, averaged wind velocity data provide information on energy availability, facilitate generator site selection and enable appropriate operating ranges to be established for windpowered plants. They also provide a basis for the prediction of extreme wind speeds.  
Author

**N74-16769\* Princeton Univ., N.J.  
AN INTRODUCTION TO THE PRINCETON SAILING WINDMILL**

T. E. Sweeney and W. B. Nixon *In* NASA. Lewis Res. Center Wind Energy Conversion Systems Dec. 1973 p 70-72 refs

**CSCL 10B**

Specifically discussed is the sailing windmill. The aerodynamic characteristics of the sailing itself are presented in condensed form and its natural application to the wind machine is discussed. Past and present sailing windmill configurations are shown and their relative merits are compared. A section on a future promising configuration is presented and its compatibility to advanced technology electrical machinery is briefly discussed. Also included is a short bibliography.  
Author

**N74-16770\* Windworks, Inc., Mukwanago, Wis.  
THE USE OF PAPER HONEYCOMB FOR PROTOTYPE BLADE CONSTRUCTION FOR SMALL TO MEDIUM-SIZED WIND DRIVEN GENERATORS**

Hans Meyer *In* NASA. Lewis Res. Center Wind Energy Conversion Systems Dec. 1973 p 73-74

**CSCL 11D**

Paper honeycomb is used for the construction of conventional, propeller-type, windmill blades. Using fairly simple techniques and conventional power tools, it is possible to shape both simple foils and more complex foils with or without tapered plan forms and with or without varying profiles. A block of honeycomb, in its compressed form, is mounted on a wedge and run through a bandsaw with the table at an appropriate tilt angle. It is the combination of the wedge angle and the table angle that gives the tapered planform and profile shape. Next the honeycomb is expanded on the shaft and jigged to give the desired angles of attack. With the honeycomb fixed in position, the blade is covered with a fine weave fiberglass cloth. Any surface quality can then be achieved with filling and sanding.  
Author

**N74-16771\* New Alchemy Inst., Woods Hole, Mass.  
THE SAIL WING WINDMILL AND ITS ADAPTATION FOR USE IN RURAL INDIA**

Marcus M. Sherman *In* NASA. Lewis Res. Center Wind Energy Conversion Systems Dec. 1973 p 75-78 refs

**CSCL 10B**

An 8 meter-diameter prototype sail wing windmill is reported that uses a one meter-diameter bullock cartwheel to which three bamboo poles are latched in a triangular pattern with overlapping ends, to form the airframe for cloth sails. This device lifts 300 pounds to a height of 20 feet in one minute in a 10 mph wind.  
G.G.

**N74-16772\* Army Air Mobility Research and Development Lab., Moffett Field, Calif.  
ROTOR DYNAMIC CONSIDERATIONS FOR LARGE WIND POWER GENERATOR SYSTEMS**

Robert A. Ormiston *In* NASA. Lewis Res. Center Wind Energy Conversion Systems Dec. 1973 p 80-88 ref

**CSCL 10B**

Successful large, reliable, low maintenance wind turbines must be designed with full consideration for minimizing dynamic response to aerodynamic, inertial, and gravitational forces. Much of existing helicopter rotor technology is applicable to this problem. Compared with helicopter rotors, large wind turbines are likely to be relatively less flexible with higher dimensionless natural frequencies. For very large wind turbines, low power output per unit weight and stresses due to gravitational forces are limiting factors. The need to reduce rotor complexity to a minimum favors the use of cantilevered (hingeless) rotor configurations where stresses are relieved by elastic deformations.  
Author

**N74-16773\* Boeing Vertol Co., Philadelphia, Pa.  
THE EFFECT OF AERODYNAMIC PARAMETERS ON POWER OUTPUT OF WINDMILLS**



W. Wiesner *In* NASA. Lewis Res. Center Wind Energy Conversion Systems Dec. 1973 p 89-95

#### CSCL 10B

Aerodynamic results for a study on windpower generation are reported. Windmill power output is presented in terms that are commonly used in rotary wing analysis, namely, power output as a function of drag developed by the windmill. Effect of tip speed ratio, solidity, twist, wind angle, blade setting and airfoil characteristics are given. Author

N74-16774\* Science Applications, Inc., La Jolla, Calif. Advanced Concepts Div.

#### VERTICAL AXIS WIND ROTORS: STATUS AND POTENTIAL

W. Vance *In* NASA. Lewis Res. Center Wind Energy Conversion Systems Dec. 1973 p 98-102

#### CSCL 10B

The design and application of a vertical axis wind rotor is reported that operates as a two stage turbine wherein the wind impinging on the concave side is circulated through the center of the rotor to the back of the convex side, thus decreasing what might otherwise be a high negative pressure region. Successful applications of this wind rotor to water pumps, ship propulsion, and building ventilators are reported. Also shown is the feasibility of using the energy in ocean waves to drive the rotor. An analysis of the impact of rotor aspect ratio on rotor acceleration shows that the amount of venting between rotor vanes has a very significant effect on rotor speed for a given wind speed. G.G.

N74-16775\* Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.

#### ADVANTAGES OF THE DIFFUSER-AUGMENTED WIND TURBINE

R. A. Oman and K. M. Foreman *In* NASA. Lewis Res. Center Wind Energy Conversion Systems Dec. 1973 p 103-106 refs

#### CSCL 10B

Performance optimization for a wind turbine is realized by using a shrouded diffuser to produce up to twice the power of unshrouded turbines of the same diameter. The diffuser converts the kinetic energy of the flow downstream of the rotor into a pressure rise and thus makes it possible for the rotor to capture airflow from a free stream tube area that is greater than that from the rotor itself. The flow velocity through the shrouded rotor is 20 to 80 percent greater than the free wind velocity as opposed to 67 percent less for the unshrouded case. The diffuser also makes it possible to accommodate very high wind speeds without the need of variable pitch in the rotor blades. G.G.

N74-16776\* California State Univ., San Diego.

#### BUCKET ROTOR WIND-DRIVEN GENERATOR

Howard H. Chang and Horace McCracken (Sunwater Co.) *In* NASA. Lewis Res. Center Wind Energy Conversion Systems Dec. 1973 p 107-108

#### CSCL 10B

As compared with the ordinary propeller type rotor, the bucket rotor is limited in rotational speed since the tip rotor speed can never exceed the wind speed. However, it does not present the blade fatigue problem that the ordinary rotor has, and it perhaps causes less sight pollution. The deflector vanes also provide a venturi passage to capture greater wind flow. The bucket rotors can be strung together end-to-end up to thousands of feet long to produce large amounts of power. Author

N74-16777\* Wisconsin Univ., Madison.

#### WIND-POWERED ASYNCHRONOUS AC/DC/AC CONVERTER SYSTEM

D. K. Reitan *In* NASA. Lewis Res. Center Wind Energy Conversion Systems Dec. 1973 p 109-114 refs

#### CSCL 10B

Two asynchronous ac/dc/ac systems are modeled that utilize wind power to drive a variable or constant hertz alternator. The

first system employs a high power 60-hertz inverter tie to the large backup supply of the power company to either supplement them from wind energy, storage, or from a combination of both at a preset desired current; rectifier and inverter are identical and operate in either mode depending on the silicon control rectifier firing angle. The second system employs the same rectification but from a 60-hertz alternator arrangement; it provides mainly dc output, some sinusoidal 60-hertz from the wind bus and some high harmonic content 60-hertz from an 800-watt inverter. G.G.

N74-16778\* Oklahoma State Univ., Stillwater.

#### AN ELECTRICAL GENERATOR WITH A VARIABLE SPEED INPUT: CONSTANT FREQUENCY OUTPUT

H. Jack Allison *In* NASA. Lewis Res. Center Wind Energy Conversion Systems Dec. 1973 p 115-120 (For

#### CSCL 10B

A new type of rotary energy conversion device for obtaining a desired constant frequency output independent of the speed of the prime mover has been developed and tested using the technique of field modulation and solid state alternator output processing. A 10-kilowatt prototype field modulated frequency down converter system was designed, built, and successfully tested. Experimentally obtained performance characteristics are presented. Author

N74-16779\* Tompkin (Joseph), Salem, Ore.

#### VOIGHT VARIABLE SPEED DRIVE

Joseph Tompkin *In* NASA. Lewis Res. Center Wind Energy Conversion Systems Dec. 1973 p 121-122

#### CSCL 10B

The variable speed drive transmission is mounted within the gondola and connected with the wind turbine blades and the hub. This unit is designed for the production of ac power. The turbine turns by means of the variable speed drive and a set of synchronous three phase generators. This motion is controlled automatically by two wind rosettes in such a way that the wind turbine always opposes the wind direction. The Voight variable speed drive is a mechanical variable positive drive gear transmission. It has an unlimited power and torque transmission, a constant ratio with high degree of accuracy, a speed variation over a wide range, and a nonslip drive. Author

N74-16780\* Oklahoma State Univ., Stillwater.

#### ENERGY STORAGE USING HIGH PRESSURE ELECTROLYSIS AND METHODS FOR RECONVERSION

William L. Hughes *In* NASA. Lewis Res. Center Wind Energy Conversion Systems Dec. 1973 p 123-129

#### CSCL 10C

Theoretical and experimental studies on high pressure electrolysis producing hydrogen and oxygen for energy storage and reversion are reported. Moderate temperature, high pressure hydrogen/oxygen fuel cells with nickel electrodes are investigated for effects of pressure, temperature, and membrane porosity. Test results from an aphodid burner turbine generator combination obtained 40 percent kilowatt hours out of the fuel cell divided by kilowatt hours into the electrolyzer. It is concluded that high pressure hydrogenation of organic materials can be used to synthesize hydrozenes and methanes for making synthetic vehicular fuels. G.G.

N74-16781\* General Electric Co., Santa Barbara, Calif.

#### USE OF HYDROGEN AND HYDROGEN-RICH COMPOUNDS AS A MEANS OF STORING AND TRANSPORTING ENERGY

Walter Hausz *In* NASA. Lewis Res. Center Wind Energy Conversion Systems Dec. 1973 p 130-134

#### CSCL 10C

A one-megawatt wind energy source is assumed that uses half of its output to serve customers as electricity, and stores the other half by conversion to hydrogen, to liquid hydrogen, to stored LH2, and back to electricity. Energy costs and capital

costs of the conversions escalate unit costs to 12.9 cents per kilowatt hour. High conversion costs can be reduced by using  $Mg_2NiH_4$  and  $FeTiH_2$  storage, or by using a 100- or 1000 megawatt system. G.G.

**N74-16782\*** General Electric Co., Lynn, Mass.

**STATUS AND APPLICABILITY OF SOLID POLYMER ELECTROLYTE TECHNOLOGY TO ELECTROLYTIC HYDROGEN AND OXYGEN PRODUCTION**

W. A. Titterton / In NASA, Lewis Res. Center Wind Energy Conversion Systems Dec. 1973 p 135-136

**CSCL 10B**

The solid polymer electrolyte (SPE) water electrolysis technology is presented as a potential energy conversion method for wind driven generator systems. Electrolysis life and performance data are presented from laboratory sized single cells (7.2 sq in active area) with high cell current density selected (1000 ASF) for normal operation. Author

**N74-16783\*** Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.

**SUPERFLYWHEEL ENERGY STORAGE SYSTEM**

David W. Rabenhorst / In NASA, Lewis Res. Center Wind Energy Conversion Systems Dec. 1973 p 137-145 refs

**CSCL 10B**

A windpowered system using the superflywheel configuration for energy storage is considered. Basic elements of superflywheels are thin rods assembled in pregrooved hub lamina so that they fan out in radial orientation. Adjacent layers of hub lamina are assembled 90 degree in rotation to each other so as to form a circular brush configuration. Thus stress concentrations and rod failure are minimized and realistic failure containment for a high performance flywheel is obtained. G.G.

**N74-16784\*** National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.

**BATTERIES FOR STORAGE OF WIND-GENERATED ENERGY**

Harvey J. Schwartz / In its Wind Energy Conversion Systems Dec. 1973 p 146-151

**CSCL 10C**

Cost effectiveness characteristics of conventional, metal gas-, and high energy alkali metal-batteries for wind generated energy storage are considered. A lead-acid battery with a power density of 20 to 30 watt/hours per pound is good for about 1500 charge-discharge cycles at a cost of about \$80 per kilowatt hour. A zinc-chlorine battery that stores chlorine as solid chlorine hydrate at temperatures below 10 C eliminates the need to handle gaseous chlorine; its raw material cost are low and inexpensive carbon can be used for the chlorine electrode. This system has the best chance to replace lead-acid. Exotic alkali metal batteries are deemed too costly at the present stage of development. G.G.

**N74-16785\*** InterTechnology Corp., Warrenton, Va.

**ENERGY STORAGE BY COMPRESSED AIR**

George C. Szego / In NASA, Lewis Res. Center Wind Energy Conversion Systems Dec. 1973 p 152-154

**CSCL 10C**

The feasibility of windpower energy storage by compressed air is considered. The system is comprised of a compressor, a motor, and a pump turbine to store air in caverns or aquifers. It is proposed that storage of several days worth of compressed air up to 650 pounds per square inch can be used to push the aquifer up closer to the container dome and thus initiate piston action by simply compressing air more and more. More energy can be put into it by pressure increase or pushing back the water in the aquifer. This storage system concept has reheat flexibility and lowest cost effectiveness. G.G.

**N74-16786\*** Jacobs Wind Electric Co., Inc., Fort Meyers, Fla.

**EXPERIENCE WITH JACOBS WIND-DRIVEN ELECTRIC**

**GENERATING PLANT, 1931 - 1957**

Marcellus L. Jacobs / In NASA, Lewis Res. Center Wind Energy Conversion Systems Dec. 1973 p 155-158

**CSCL 10B**

Engineering, construction, performance, electric output, and different uses of the wind electric 2500- to 3000-watt plant are outlined. After several years of testing different types of windmills, the three blade aeroplane type of propeller was found to be far superior in power output. By means of a flyball governor operated, variable pitch speed control, the maximum speed of the propeller was accurately and easily controlled, to prevent excessive speeds in high winds and storms. The three blade propeller was found to be necessary to prevent excessive vibration whenever the shift of the wind direction required the plant to change its facing direction on the tower. Author

**N74-16787\*** McGill Univ., Montreal (Quebec), MacDonald Coll.

**REVIEW OF THE WINDPOWER ACTIVITIES AT THE BRACE RESEARCH INSTITUTE**

T. A. Lawand / In NASA, Lewis Res. Center Wind Energy Conversion Systems Dec. 1973 p 159-164 refs

**CSCL 10B**

A chronology of windpower studies at the experimental station on Barbados is presented that includes the various development activities on wheeling windmills whose power output is utilized through electrical and electronic systems. A list of institute publications on windpower is included. G.G.

**N74-16788\*** Solar Wind Co., East Holden, Maine.

**WIND POWER SYSTEMS FOR INDIVIDUAL APPLICATIONS**

Henry M. Clews / In NASA, Lewis Res. Center Wind Energy Conversion Systems Dec. 1973 p 165-169

**CSCL 10B**

A small windpower system is described which is suitable for electrifying a house. The self-contained unit consists of a two kilowatt wind driven generator, a set of 19 storage batteries, a small dc to ac inverter, and a gasoline generator for use as an emergency backup system in case of prolonged calm periods. Cost effectiveness of the electricity generated by this windmill system comes out to about 15 cents per kilowatt hour - assuming a 10 year life for the batteries and a 20 year life for the other components. Some other small windpower systems are also described, and it is shown that a windpowered generator in the 15- to 25-kilowatt output range coupled to a direct heated water storage system is able to heat a typical New England home. G.G.

**N74-16789\*** Pennwalt Corp., Houston, Tex.

**ECONOMIC CONSIDERATIONS OF UTILIZING SMALL WIND GENERATORS**

Robert Dodge / In NASA, Lewis Res. Center Wind Energy Conversion Systems Dec. 1973 p 170-173

**CSCL 10B**

The economic feasibility of small wind generators is compared to that of solar cells, primary batteries, thermoelectric generators, and engine generators. It is shown that small wind generator plants offer an attractive alternative to primary battery systems and constantly running engines to generate power in remote areas. The limitation is an annual average wind velocity of at least 9 to 10 mph. Presently available units are most useful in the average load range of 10 to 1000 watts. G.G.

**N74-16790\*** Hydro-Quebec Inst. for Research, Varennes.

**WIND UTILIZATION IN REMOTE REGIONS: AN ECONOMIC STUDY**

James H. VanSant / In NASA, Lewis Res. Center Wind Energy Conversion Systems Dec. 1973 p 174-176

**CSCL 10C**

A wind driven generator was considered as a supplement to a diesel group, for the purpose of economizing fuel when wind power is available. A specific location on Hudson's Bay, Povungnituk, was selected. Technical and economic data available for a wind machine of 10-kilowatt nominal capacity and available wind data for that region were used for the study. After subtracting the yearly wind machine costs from savings in fuel costs, a net savings of \$1400 per year is realized. These values are approximate, but are thought to be highly conservative. Author

**N74-16791\*** Montana State Univ., Bozeman.  
**TECHNICAL FEASIBILITY STUDY FOR THE DEVELOPMENT OF A LARGE CAPACITY WIND POWERED ELECTRICAL GENERATING SYSTEM**

Ralph E. Powe In NASA, Lewis Res. Center Wind Energy Conversion Systems Dec. 1973 p 177-179

**CSCL 10C**

The engineering feasibility of developing a basic mechanical system necessary for extracting large amounts of power (on the order of 10 to 20 MW) from the wind is considered using the concept of vertical airfoils moving along a closed horizontal track system. Attention is focused on those components necessary for the conversion of wind energy to mechanical energy, although the general characteristics and critical aspects of other components are also considered. The four phases of this program are: (1) Establishment of component specifications and interface requirements for major system components; (2) formulation of alternative sets of conceptual designs for major system components; (3) engineering analysis of various components and systems; and (4) re-examination of basic concept and identification of any desirable follow-up work. Author

**N74-16792\*** Oregon State Univ., Corvallis.  
**THE OREGON STATE UNIVERSITY WIND STUDIES**  
 Robert E. Wilson In NASA, Lewis Res. Center Wind Energy Conversion Systems Dec. 1973 p 180-185

**CSCL 10C**

The economic feasibility of commercial use of wind generated power in selected areas of Oregon is assessed. A number of machines for generating power have been examined. These include the Savonius rotor, translators, conventional wind turbines, the circulation controlled rotor and the vertical axis winged turbine. Of these machines, the conventional wind turbine and the vertical axis winged turbine show the greatest promise on the basis of the power developed per unit of rotor blade area. Attention has been focused on the structural and fatigue analysis of rotors since the economics of rotary winged, wind generated power depends upon low cost, long lifetime rotors. Analysis of energy storage systems and tower design has also been undertaken. An economic means of energy storage has not been found to date. Tower design studies have produced cost estimates that are in general agreement with the cost of the updated Putnam 110-foot tower. Author

**N74-16793\*** Aerowatt Corp., Paris (France).  
**FRENCH WIND GENERATOR SYSTEMS**  
 John M. Noel In NASA, Lewis Res. Center Wind Energy Conversion Systems Dec. 1973 p 186-196

**CSCL 10B**

The experimental design of a wind driven generator with a rated power of 800 kilovolt amperes and capable of being connected to the main electrical network is reported. The rotor is a three bladed propeller; each blade is twisted but the fixed pitch is adjustable. The asynchronous 800-kilovolt ampere generator is driven by the propeller through a gearbox. A dissipating resistor regulates the machine under no-load conditions. The first propeller on the machine lasted 18 months; replacement of the rigid propeller with a flexible structure resulted in breakdown due to flutter effects. Author

**N74-16794\*** Massachusetts Univ., Amherst.  
**A PROPOSED NATIONAL WIND POWER R AND D PROGRAM**

William Heronemus In NASA, Lewis Res. Center Wind Energy Conversion Systems Dec. 1973 p 197-203

**CSCL 10B**

An offshore wind power system is described that consists of wind driven electrical dc generators mounted on floating towers in offshore waters. The output from the generators supplies underwater electrolyzer stations in which water is converted into hydrogen and oxygen. The hydrogen is piped to shore for conversion to electricity in fuel cell stations. It is estimated that this system can produce  $159 \times 10^6$  to the ninth power kilowatt-hours per year. It is concluded that solar energy - and that includes wind energy - is the only way out of the US energy dilemma in the not too distant future. Author

**N74-16795\*** Budgen and Associates, Pointe Claire (Quebec).  
**A COMMENT ON TOWERS FOR WINDMILLS**  
 Harry P. Budgen In NASA, Lewis Res. Center Wind Energy Conversion Systems Dec. 1973 p 204-205

**CSCL 10B**

Design considerations for windmill tower structures include the effects of normal wind forces on the rotor and on the tower. Circular tabular or masonry towers present a relatively simple aerodynamic solution. Economic factors establish the tubular tower as superior for small and medium sized windmills. Concrete and standard concrete block designs are cheaper than refabricated steel structures that have to be freighted. G.G.

**N74-16796\*** Stuttgart Univ. (West Germany).  
**SOME EXTEMPORANEOUS COMMENTS ON OUR EXPERIENCES WITH TOWERS FOR WIND GENERATORS**  
 Ulrich Hutter In NASA, Lewis Res. Center Wind Energy Conversion Systems Dec. 1973 p 206-207

**CSCL 10B**

A wind generator tower must be designed to withstand fatigue forces and gust winds loads. Optimum tower height depends on the energy cost to the customer because an increase in height results in an increase in the cost of the plant. It is suggested that costs are minimum for the shortest tower possible and that the rotor should be as large as possible. G.G.

**N74-16797\*** AeroVironment, Inc., Pasadena, Calif.  
**WIND MACHINES** c20  
 P. B. S. Lissaman In NASA, Lewis Res. Center Wind Energy Conversion Systems Dec. 1973 p 208-239

**CSCL 04B**

The basic elements of the air/water momentum exchange are described by the environment, the potential, the air and water subsystems, the total system, and the rule. Many of these topics have direct analogues in aerogenerator design. Aspects of optimal sail design and of waveless hulls are briefly outlined. A wind driven vehicle capable of moving directly downwind faster than the wind, is reported. The lecture is illustrated with slides and movie clips showing surfing catamarans, land and water versions of the Bauer vehicle, hang gliding, land sailing, and wind surfing. Author

**N74-16798\*** National Science Foundation, Washington, D.C.  
**NSF PRESENTATION**  
 Frederick H. Morse In NASA, Lewis Res. Center Wind Energy Conversion Systems Dec. 1973 p 240-243

**CSCL 10B**

Wind energy conversion research is considered in the framework of the national energy problem. Research and development efforts for the practical application of solar energy -- including wind energy -- as alternative energy supplies are assessed in: (1) Heating and cooling of buildings; (2) photovoltaic energy conversion; (3) solar thermal energy conversion; (4) wind energy conversion; (5) ocean thermal energy conversion; (6) photosynthetic production of organic matter; and (7) conversion of organic matter into fuels. G.G.

**N74-16799\*** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

# **NASA PRESENTATION**

Ronald L. Thomas *In its Wind Energy Conversion Systems*. Dec. 1973 p 244-253

CSCL 10B

The development of a wind energy system is outlined that supplies reliable energy at a cost competitive with other energy systems. A government directed industry program with strong university support is recommended that includes meteorological studies to estimate wind energy potentials and determines favorable regions and sites for wind power installations. Key phases of the overall program are wind energy conversion systems, meteorological wind studies, energy storage systems, and environmental impact studies. Performance testing with a prototype wind energy conversion and storage system is projected for Fiscal 1977.

G.G.

**N74-16800\*** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

# **H2-O2 COMBUSTION POWERED STEAM-MHD CENTRAL POWER SYSTEMS**

G. R. Seikel, J. M. Smith, and L. D. Nichols 1974 14 p refs Presented at Hydrogen Economy Miami Energy Conf., Miami Beach, Fla., 18-20 Mar. 1974; sponsored by Univ. of Miami (NASA-TM-X-71512; E-7890) Avail: NTIS HC \$3.00 CSCL 10B

Estimates are made for both the performance and the power costs of H2-O2 combustion powered steam-MHD central power systems. Hydrogen gas is assumed to be transmitted by pipe from a remote coal gasifier into the city and converted to electricity in a steam MHD plant having an integral gaseous oxygen plant. These steam MHD systems appear to offer an attractive alternative to both in-city clean fueled conventional steam power plants and to remote coal fired power plants with underground electric transmission into the city.

Author

# **N74-16801\*** Linguistic Systems, Inc., Cambridge, Mass. USING THE ENERGY OF THE WIND FOR ELECTRIFICATION

V. R. Sektorov Washington NASA Feb. 1974 18 p Transl. into ENGLISH from Elektrichestvo, (USSR), no. 3 March 1953 p 11-16

(Contract NASw-2482)

(NASA-TT-F-15307) Avail: NTIS HC \$4.00 CSCL 10A

The utilization of wind energy for generating electric power is discussed. Existing power generators utilizing wind energy are described and their use in agriculture is indicated.

Author

**N74-16802\*** Scientific Translation Service, Santa Barbara, Calif.

# **THE ECONOMY AND PRACTICALITY OF LARGE SCALE WIND GENERATION STATIONS (CONCLUSION)**

H. Witte Washington NASA Feb. 1974 15 p refs Transl. into ENGLISH from Elektrotech. Z. (Berlin-Charlottenburg), v. 59, no. 52, 29 Dec. 1938 p 1404-1407

(Contract NASw-2483)

(NASA-TT-F-15348) Avail: NTIS HC \$4.00 CSCL 10B

The design and operational problems of wind power generating stations are discussed. Wind power generating stations are found to be economical for operation in conjunction with existing generating stations. Very large ring generator stations are described.

Author

**N74-16803\*** Linguistic Systems, Inc., Cambridge, Mass.

# **A WIND PLANT TO POWER SEA SIGNALS**

F. Baumeister Washington NSA Feb. 1974 17 p Transl. into ENGLISH from elektrotech. Z. (Berlin-Charlottenburg), v. 7, no. 12, 21 Dec. 1955 p 437-441

(Contract NASw-2482)

(NASA-TT-F-15356) Avail: NTIS HC \$4.00 CSCL 10B

On the basis of the experience with the Schleimunde windpower plant, it may be said in conclusion that economic operation of such a windpower plant is feasible whenever, on the one hand, the cost of connecting the consumers to the

public network is prohibitive, and on the other hand sufficient wind is available. The planning of long term duration and force reading is of particular value. It is advantageous to erect windpower plants in coastal and mountain regions.

Author

**N74-16807\*** Arizona Univ., Tucson. Dept. of Electrical Engineering.

# **INVERSION LAYER SOLAR CELL FABRICATION AND EVALUATION Final Report**

R. L. Call Sep. 1973 95 p Prepared for JPL

(Contracts NAS7-100; JPL-953461)

(NASA-CR-136932) Avail: NTIS HC \$8.00 CSCL 10A

Silicon solar cells operating with induced junctions rather than diffused junctions have been fabricated and tested. Induced junctions were created by forming an inversion layer near the surface of the silicon by supplying a sheet of positive charge above the surface. This charged layer was supplied through three mechanisms: (1) applying a positive potential to a transparent electrode separated from the silicon surface by a dielectric, (2) contaminating the oxide layer with positive ions, and (3) forming donor surface states that leave a positive charge on the surface. A movable semi-infinite shadow delineated the extent of sensitivity of the cell due to the inversion region. Measurements of the response of the inversion layer cell to light of different wavelengths indicated it to be more sensitive to the shorter wavelengths of the sun's spectrum than conventional cells. The greater sensitivity occurs because of the shallow junction and the strong electric field at the surface.

Author

**N74-16809#** Brookhaven National Lab., Upton, N.Y.

# **HYDROGEN ECONOMY**

V. L. Sailor 1973 23 p refs Presented at Seminar on Novel Power Sources for a Power Hungry World, Baltimore Sponsored by AEC

(BNL-18224) Avail: NTIS HC \$3.25

A brief discussion is given of the possibilities of synthetic-fuel energy conversion cycles. The advantages and disadvantages of using coal and oil shale products are indicated. Environmental and economical problems which remain during the product of synthetic fuels from coal and oil shale, and the advantages and disadvantages of hydrogen as a synthetic fuel are outlined. Technical problems involve storage and on-board tankage for vehicles and aircraft. Safety problems are also discussed.

NSA

**N74-16810#** Sandia Labs., Albuquerque, N.Mex.

# **ECONOMIC COMPARISON OF TWO SOLAR/HYDROGEN CONCEPTS**

W. H. McCulloch, R. B. Pope, and D. O. Lee Oct. 1973 12 p refs

(Contract AT(29-1)-789)

(SLA-73-900) Avail: NTIS HC \$3.00

Two concepts for producing hydrogen from solar energy are examined. The utilization of solar energy and the concept of a hydrogen fuel both have drawbacks. Solar energy is intermittent, interrupted by the diurnal cycle of available sunlight and by weather conditions. Most systems designed to use solar energy include an expensive energy storage mechanism to meet demands during periods when there is no incident solar radiation. Hydrogen generation plants would require large amounts of energy input. The concepts described utilize parameters typical of operation in Albuquerque, New Mexico. It is assumed that the collectors are positioned with the axes in a north-south plane, tilted 35 deg from the horizontal toward the south, with spacing between collectors equal to the collector dimensions.

NSA

**N74-16815#** Systems Research Labs., Inc., Dayton, Ohio.

# **KIVA-I MHD GENERATOR MODIFICATIONS AND TESTS Technical Report, 28 Feb. 1972 - 31 Mar. 1973**

Lester W. Buechler and Robert A. Nimmo Aug. 1973 241 p refs

(Contract F33615-71-C-1425)

(AD-770063; AFAPL-TR-73-71) Avail: NTIS CSCL 10/2

The AFAPL-MHD Facility (KIVA-I) was used to conduct an extensive series of tests on the pegwall diagonally connected generator. Extensive knowledge was gained in the areas of

conductivity, oxygen-to-fuel ratios, interelectrode connection angles, seed particle geometry, and optimum loading conditions. A peak power of 210 KW was achieved. A DC-to-DC Inverter was successfully operated on the MHD generator, providing an output of 50 KW at 50 KV dc. Numerous modifications were made to the KIVA-I facility, including a new high-speed data acquisition system, a close circuit television system, a pulse-control network for the main burner, a new set of pole faces for the magnet, a digital display panel, and an instrumented copper electrode assembly. Author (GRA)

**N74-16816#** Army Foreign Science and Technology Center, Charlottesville, Va.

#### **DIRECT ENERGY CONVERSION METHODS**

B. P. Nesterov and V. I. Rydnyk 24 Jul. 1973 31 p Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Fiz. (Tomsk), no. 7, 1971 p 32

(AD-770000; FSTC-HT-23-131-73) Avail: NTIS CSCL 10/2

Magnetohydrodynamic generators, thermoelectric and thermion generators are discussed. Data are presented for experimental installations of these generators in the Soviet Union. GRA

**N74-16819#** Army Construction Engineering Research Lab., Champaign, Ill.

#### **ADVANCED ELECTRICAL POWER GENERATION AND DISTRIBUTION CONCEPTS FOR MILITARY FACILITIES**

Jun. 1973 134 p refs

(DA Proj. 4A0-62112-A-891)

(AD-765476; CERL-PR-E-13) Avail: NTIS CSCL 10/2

The report describes probable technical advancement of electrical power generation systems in the 1980-1990 time period for application in fixed or semi-fixed military facilities in the power range of 250 kw to 50,000 kw. Subjects covered include commercial power reliability, uninterruptible power system, conventional steam, diesel, gas turbine (open and closed cycle) generators and distribution systems for currently available equipment. Advanced power systems include nuclear reactors, batteries and fuel cells, magnetohydrodynamic systems, fusion systems, solar power systems and direct conversion systems of the thermoelectric and thermionic type. (Modified author abstract) GRA

**N74-16996#** Rocket Propulsion Establishment, Westcott (England).

#### **THE PRODUCTION OF LIQUID HYDROGEN AT THE ROCKET PROPULSION ESTABLISHMENT**

R. Bainbridge and T. R. Horton Dec. 1971 60 p refs

(RPE-TR-71/17; BR36685) Avail: NTIS HC \$6.00

The design, development and operation of a liquid hydrogen plant with an hourly output of 100 liters of normal liquid hydrogen or 70 liters of 85-90 per cent parahydrogen are described. In a period of six months over 40,000 liters of 85-90 per cent parahydrogen was produced, most of which was used in support of ELDO projects. The performance of a pre-cooled Linde cycle is examined and the major design concepts required to ensure a safe reliable production facility are discussed. ESRO

**N74-17190** Brigham Young Univ., Provo, Utah.

#### **KINETICS OF COAL GASIFICATION IN A LOW PRESSURE, LOW RESIDENCE TIME, ENTRAINED FLOW REACTOR**

Ph.D. Thesis

Chiang-Liu Chen 1973 192 p

Avail: Univ. Microfilms Order No. 73-31405

Experimental studies were made with a small entrained reactor in which the finely-ground coal entrained in carrier gas was rapidly mixed with oxidizing combustion gases. A maximum of 66.5 percent coal was gasified in 0.012 seconds. The char formation was an overall zero order while the acetylene decomposition was a second order reaction with a frequency factor of 4 times 10 to the 7th power and an activation energy of about 12 Kcal/mole. The residence time of less than 0.050 seconds is sufficient for hydrocarbon gas production. Higher residence time resulted in lower gasification because of partial

decomposition of hydrocarbons to elementary carbon.

Dissert. Abstr.

**N74-17454#** Paris Univ., Orsay (France). Lab. of Plasma Physics.

#### **DESCRIPTION OF THE ENERGY SOURCE-PROJECT DELIVERING 1 MEGAJoule IN 1 MICROSECOND [DESCRIPTION DU PROJET D'UNE SOURCE D'ENERGIE DELIVRANT 1 MEGAJoule EN 1 MICROSECONDE]**

F. Damidau and C. Rioux Apr. 1972 17 p refs in FRENCH

(LF-3) Avail: NTIS HC \$4.00

The project for a high energy source delivering one MJ in one microsecond using a unipolar autoexcited ironless rotating generator is presented. Three subsystems are detailed: (1) the primary source mentioned above, delivering one MJ in 0.1 second with one MA current coupled to a magnetic storage coil, (2) a primary transfer coil with high efficiency (transfer time 100 microsecond and associated switching gear; and (3) a secondary transfer coil to reach one microsecond. Circuit breakers required for the various connections are detailed with regard to mechanical devices and exploding wire techniques. Mutually coupled inductances used for high efficiency transfer are described and the sequence of switch operations detailed. ESRO

**N74-17523#** Southwest Research Inst., San Antonio, Tex. Army Fuels and Lubricants Research Lab.

#### **PERFORMANCE OF ARMY ENGINES WITH LEADED AND UNLEADED GASOLINE. PHASE 1: LABORATORY TESTING Interim Report**

J. A. Russell, J. D. Tosh, A. A. Johnston, J. V. Moffitt, and C. A. Moses Jan. 1973 135 p refs

(Contract DAAD05-72-C-0427)

(AD-766760; AFRL-21) Avail: NTIS CSCL 21/7

Six different types of Army engines were endurance tested on dynamometers for 125 hr each, using three grades of military Federal specification gasoline having typical conventionally leaded, low-lead, and unleaded concentrations of lead antiknock additives, respectively. All six engine types performed satisfactorily on all gasoline blends from the standpoints of (1) catastrophic failure, (2) excessive valve or cylinder wear, (3) engine power output and fuel and oil consumption, and (4) emissions degradation. (Modified author abstract) Author

**N74-17527#** Argonne National Lab., Ill.

#### **SOLAR ENERGY EVALUATION GROUP REPORT**

Aug. 1973 48 p refs

(Contract W-31-109-eng-38)

(ANL-8045) Avail: NTIS HC \$4.00

A partial reviews of the status of various phases of solar-energy utilization and of some of the areas of potentially profitable research is reported. The review covers the biological and in vitro aspects of the photochemical conversion of solar energy; the photovoltaic, photothermal, and thermoelectric studies of the physical-conversion process; the use of solar energy for heating and cooling buildings; and the central-station power approach. Author (NSA)

**N74-17642#** National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.

#### **EMISSIONS OF NITROGEN OXIDES FROM AN EXPERIMENTAL HYDROGEN-FUELED GAS TURBINE COMBUSTOR**

Carl T. Norgren and Robert D. Ingebo Washington Feb. 1974 22 p refs

(NASA-TM-X-2897; E-7745) Avail: NTIS HC \$3.00 CSCL 21E

The effect of operating variables of a hydrogen fueled combustor on exhaust concentrations of total oxides of nitrogen was determined at inlet-air temperature levels up to 810 K, pressure of 414,000 N/sa m, and reference velocity of 21.3 m/sec. The combustor, which was originally designed for hydrocarbon fuel produced a NO(x) concentration of 380 ppm with hydrogen at 810 K inlet-air temperature. A reduction in NO(x) of about 30 % was obtained by modification to a lean or rich primary

zone. The lowest NO(x) levels obtained with hydrogen were equivalent to those of the reference combustor burning hydrocarbon fuels. Author

**N74-17660** Central Electricity Generating Board, London (England).

**ECONOMETRIC MODELS: THEIR APPLICATION TO THE ECONOMIC AND ENERGY SECTORS**

G. G. Kinnane, comp. Dec. 1973 26 p refs (CE-Bibl-220) Avail: Issuing Activity

A bibliography of abstracts on econometric models and their application to the economy and energy sectors is presented. The bibliography has 101 references. E.H.W.

**N74-17661#** Joint Publications Research Service, Arlington, Va.

**TRANSLATIONS ON EASTERN EUROPE SCIENTIFIC AFFAIRS, NO. 383**

30 Jan. 1974 29 p refs Transl. into ENGLISH from various East European periodicals (JPRS-61101) Avail: NTIS HC \$3.50

Romanian research is reported in the areas of: (1) digital processing and transmission of information, and (2) fuel savings with thermoenergetic equipment.

**N74-17663** Joint Publications Research Service, Arlington, Va. **ROLE OF THERMOENERGETIC RESEARCH IN SAVING FUEL** c33

Teofil Popovici and D. Marian /In its Transl. on: Eastern Europe Sci. Affairs, No. 383 (JPRS-61101) 30 Jan. 1974 p 24-26 Transl. into ENGLISH from Romania Libera (Bucharest), 18 Nov. 1973 2 p

A question and answer interview with the director of the Romanian Research and Design Institute for Thermoenergetic Equipment is reported. The interview involves proposals of concrete methods by which researchers and designers of thermoenergetic equipment can help to better use the fuel in the national economy. Author

**N74-17666#** Bureau of Mines, Washington, D.C. Office of Economic Analysis.

**DETERMINING THE EFFECTS OF GASOLINE PRICE ON USE OF METALS IN AUTOMOBILE MANUFACTURE**

Phillip N. Yasnowsky and Donald S. Colby 1974 18 p refs (BM-RI-7871) Avail: NTIS HC \$4.00

An attempt was made to relate the size of automobiles to the price of gasoline, and the use of minerals in automobile manufacture to the size of automobiles. Only one of the many plausible scenarios of public reaction to higher gasoline prices, a switch to economy size automobiles, is developed. No account is taken of other potential impacts such as improvements in public transportation or increased occupancy per vehicle. Furthermore, a gasoline price increase is the only incentive to the greater utilization of economy cars that is considered. A gasoline price increase to \$0.60 per gallon would reduce the amount of minerals required to produce the automobiles sold in the United States by an estimated 15 percent. Gasoline prices of \$0.80 and \$1 per gallon would cause declines in mineral requirements for U.S. automobile sales estimated at 26 percent and 35 percent, respectively. Author

**N74-17669#** Committee on Interior and Insular Affairs (U. S. Senate).

**A REVIEW OF ENERGY POLICY ACTIVITIES OF THE 92D CONGRESS**

1973 87 p refs Presented to Comm. on Interior and Insular Affairs, 93d Congr., 1st Sess., 30 Dec. 1972 Prepared by Library of Congr.

Avail: Comm. on Interior and Insular Affairs

The provision of an adequate supply of all needed forms of energy at reasonable and stable prices, with incentive for their continued adequate provision, without degradation of the environment or jeopardy to the national security, and with minimum waste is discussed. Three basic areas are discussed:

the legislation that was enacted; the legislation that was proposed but not enacted; and the hearings that were held by the various committees and subcommittees of the Congress. In addition, reports concerning energy that were issued are included. Author

**N74-17680#** Oak Ridge National Lab., Tenn.

**NSF-RANN ENERGY ABSTRACTS: A MONTHLY ABSTRACT JOURNAL OF ENERGY RESEARCH**

M. P. Guthrie, ed. Sep. 1973 24 p refs Sponsored in part by NSF

(Contract W-7405-eng-26)

(ORNL-EIS-73-52-Vol-1-No-9) Avail: NTIS HC \$3.25

One-hundred abstracts are presented of recently published articles on energy resources; energy conversion; energy production, consumption, economics, and policy; electric power production consumption, and transmission; and environmental studies related to power production and use. Each abstract is accompanied by the following information: title; author; corporate author with address; publication description; publication date; research sponsor; and availability. NSA

**N74-17685#** Technische Hogeschool, Delft (Netherlands).

**AVIATION NEEDS AND PUBLIC CONCERNS**

Emile VanLennep (Organ. for Econ. Co-operation and Develop., Paris) 1973 39 p Presented at 7th Dr. Albert Plesman Memorial Lecture, Delft, Neth., 29 Oct. 1973

Avail: NTIS HC \$5.00

The seventh Dr. Albert Plesman Memorial Lecture deals with the problems of aviation needs and public concerns. The problems of aircraft noise, and its reduction, are discussed. The growing demands on energy resources are coupled with the rising fuel prices. The growing scarcity of land suitable for airport sites is illustrated. Some background data is provided from related OECD studies. ESRO

**N74-17779#** Battelle Columbus Labs., Ohio.

**GENERAL AVIATION COST IMPACT STUDY. VOLUME 1: EXECUTIVE SUMMARY Final Report**

J. W. Chadwick, T. W. Hall, E. T. Yeager, and R. W. Cote Jun. 1973 36 p refs

(Contract DOT-FA72WA-3118)

(AD-771803) Avail: NTIS CSCL 01/3

The report in four volumes presents the results of an analysis of the effects of cost changes on general aviation activity. The major objectives of the study were to investigate ownership and operating costs in each segment of general aviation, and to develop methodology for evaluating the cost impact of regulatory changes on general aviation activity. The study effort included compilation of a cost and activity data base, definition of fixed and variable cost centers, determination of cost sensitivity relationships and determination of cost impact relationships. Volume 1 provides a summary of the overall study. (Modified author abstract) GRA

**N74-17780#** Battelle Columbus Labs., Ohio.

**GENERAL AVIATION COST IMPACT STUDY. VOLUME 2: RESEARCH METHODOLOGY Final Report**

J. W. Chadwick, T. W. Hall, E. T. Yeager, and R. W. Cote Jun. 1973 133 p

(Contract DOT-FA72WA-3118)

(AD-771806) Avail: NTIS CSCL 01/3

The report in four volumes presents the results of an analysis of the effects of cost changes on general aviation activity. Volume 2 presents the rationale and methodology used in the analysis. (Modified author abstract) GRA

**N74-17781#** Battelle Columbus Labs., Ohio.

**GENERAL AVIATION COST IMPACT STUDY. VOLUME 3: PLANNING GUIDE Final Report**

J. W. Chadwick, T. W. Hall, E. T. Yeager, and R. W. Cote Jun. 1973 218 p

(Contract DOT-FA72WA-3118)

(AD-771759) Avail: NTIS CSCL 01/3

The report in four volumes presents the results of an analysis

of the effects of cost changes on general aviation activity. The major objectives of the study were to investigate ownership and operating costs in each segment of general aviation, and to develop methodology for evaluating the cost impact of regulatory changes on general aviation activity. The study effort included compilation of a cost and activity data base, definition of fixed and variable cost centers, determination of cost sensitivity relationships and determination of cost impact relationships. The results are presented in graphical form in Volume 3 of this report to facilitate easy use. (Modified author abstract) GRA

**N74-17784\*** Little (Arthur D.), Inc., Cambridge, Mass.  
**FEASIBILITY STUDY OF A SATELLITE SOLAR POWER STATION** Final Report

Peter E. Glaser, Owen E. Maynard (Raytheon Co., Sudbury, Mass.), John Mackovciak, Jr. (Grumman Aerospace Corp.), and Eugene L. Ralph (Spectrolab, Inc., Sylmar, Calif.) Washington NASA Feb. 1974 199 p refs  
 (Contract NAS3-16804)

(NASA-CR-2357; ADL-C-74830) Avail: NTIS HC \$5.50 CSCL 10A

A feasibility study of a satellite solar power station (SSPS) was conducted: (1) to explore how an SSPS could be "flown" and controlled in orbit; (2) to determine the techniques needed to avoid radio frequency interference (RFI); and (3) to determine the key environmental, technological, and economic issues involved. Structural and dynamic analyses of the SSPS structure were performed, and deflections and internal member loads were determined. Desirable material characteristics were assessed and technology developments identified. Flight control performance of the SSPS baseline design was evaluated and parametric sizing studies were performed. The study of RFI avoidance techniques covered: (1) optimization of the microwave transmission system; (2) device design and expected RFI; and (3) SSPS RFI effects. The identification of key issues involved (1) microwave generation, transmission, and rectification and solar energy conversion; (2) environmental-ecological impact and biological effects; and (3) economic issues. The feasibility of the SSPS based on the parameters of the study was established. Author

**N74-17786\*** Linguistic Systems, Inc., Cambridge, Mass.  
**DC GENERATOR FOR KOLKHOZ WIND POWERED GENERATORS**

K. I. Shenfer and A. Ivanov Washington NASA Mar. 1974 11 p refs Transl. into ENGLISH from Elektrichestvo (USSR), v. 61, 1940 p 14-16

(Contract NASw-2482)

(NASA-TT-F-15347) Avail: NTIS HC \$4.00 CSCL 10A

The use of carborundum-graphite resistors to control the voltage output from small wind-powered generators is described. Experiments were performed for devising methods of regulating dc generators to supply constant voltage, and a new type of nonlinear resistor was developed for use as a regulator. Author

**N74-17787\*** Linguistic Systems, Inc., Cambridge, Mass.  
**THE PRESENT STATUS OF HONNEF WIND POWER PLANTS**

P. Juchem Washington NASA Feb. 1974 19 p refs Transl. into ENGLISH from Elektrotech. Z. (West Germany), Ausgabe 8, v. 7, no. 5, 21 May 1955 p 187-191

(Contract NASw-2482)

(NASA-TT-F-15355) Avail: NTIS HC \$4.00 CSCL 10A

The most important energy sources on earth, next to the sun and water, are coal and oil. However, it seems that these deposits will be exhausted in the foreseeable future. Large windpower plants are destined to play an important role in the tapping of new energy sources. Their viability must be judged from the research and development work carried out in the U.S.S.R., the U.K., the U.S.A., and Germany. Author

**N74-17788\*** Boeing Aerospace Co., Seattle, Wash. Kent Space Center.

**HIGH VOLTAGE SOLAR ARRAY EXPERIMENTS** Final Report

K. L. Kennerud Mar. 1974. 136 p refs

(Contract NAS3-14364)

(NASA-CR-121280) Avail: NTIS HC \$10.00 CSCL 10A

The interaction between the components of a high voltage solar array and a simulated space plasma is studied to obtain data for the design of a high voltage solar array capable of 15kW at 2 to 16kV. Testing was conducted in a vacuum chamber 1.5-m long by 1.5-m diameter having a plasma source which simulated the plasma conditions existing in earth orbit between 400 nautical miles and synchronous altitude. Test samples included solar array segments pinholes in insulation covering high-voltage electrodes, and plain dielectric samples. Quantitative data are presented in the areas of plasma power losses, plasma and high voltage induced damage, and dielectric properties. Limitations of the investigation are described. Author

**N74-17789\*** Scientific Translation Service, Santa Barbara, Calif.

**THE dc GENERATORS FOR UTILIZING WIND POWER**

Antonio Carrer Washington NASA Mar. 1974 26 p refs Transl. into ENGLISH from Elettrotecnica (Milan), v. 36, 10-25 Aug. p 376-383

(Contract NASw-2483)

(NASA-TT-F-15351) Avail: NTIS HC \$4.50 CSCL 10A

Theoretical considerations are explained and experimental findings pertaining to the possibility of utilizing wind power with electromechanical units comprising various types of direct current machines. Author

**N74-17790\*** Little (Arthur D.), Inc., Cambridge, Mass.

**NEW SOURCES OF POWER: SOLAR ENERGY**

Peter E. Glaser Sep. 1973 13 p Presented at the World Energy Supplies Conf., London, 18-20 Sep. 1973

Avail: NTIS HC \$4.00

Two obstacles to harnessing solar energy, storage and collection, are discussed in terms of solar heating and cooling systems for buildings. The cost ranges for heating with solar energy are compared with the use of conventional fuels. Photovoltaic conversion of solar energy is discussed along with solar energy conversion in space, solar heat engine power plants, wind energy, and ocean thermal gradients for powering large heat engines. K.M.M.

**N74-17791\*** Yardney Electric Corp., Pawcatuck, Conn.  
**DEVELOPMENT AND FABRICATION OF SEALED SILVER-ZINC CELLS, PHASE 1** Final Report

Ivan C. Blake and C. Philip Donnel, III Dec. 1973 56 p refs (Contract NAS3-16805)

(NASA-CR-134591) Avail: NTIS HC \$6.00 CSCL 10C

A facility was designed, constructed and equipped for the production of prismatic alkaline rechargeable battery cells using inorganic (ceramic) separators. This unique facility is environmentally controlled and contains separate areas for electrode fabrication, separator processing, cell assembly, cell finishing and testing. An initial production run of 125 sealed silver zinc cells, using inorganic separators, was made in the facility in order to provide samples for baseline performance tests. Ten of these cells were given performance characterization and life cycle tests. Author

**N74-17792\*** Kanner (Leo) Associates, Redwood City, Calif.  
**WIND POWER, PART 2 - ECONOMIC FEASIBILITY, 1949**

G. Lacroix Washington NASA Mar. 1974 23 p refs Transl. into ENGLISH from Tech. Mod. (France), v. 41, nos. 7, 8, 1-5 Apr. 1949

(Contract NASw-2481)

(NASA-TT-F-15419) Avail: NTIS HC \$4.25 CSCL 10A

Both classical and theoretical methods for preventing wind engines from overspeeding are described. The greatest drawback in the use of these devices is seen to be their inability to compete with other power sources on an economic basis. In this connection there is a detailed description of the failure of the Grandpa's Knob experiment conducted in Vermont in the early 1940's; the technical defects were minor in comparison to the lack of economic feasibility. Russian efforts and Danish projects are discussed briefly. Author

**N74-17795#** Mitro Corp., McLean, Va. Systems Development Div.

# **SOLAR ENERGY SYSTEMS**

Frank R. Eldridge Mar. 1973 100 p refs

(M73-28) Avail: NTIS HC \$8.00

Alternative solar energy systems that can be used for generating electricity and producing hydrogen fuels are reviewed. Particular attention is given to the possibility of employing photovoltaic cells to collect the solar energy. Different system sizes are explored, ranging from small household systems of a few kilowatts output, to large systems capable of producing, transmitting, storing, and distributing a major portion of the U.S. energy requirements by the year 2000. Author

**N74-17797#** Purdue Univ., Lafayette, Ind. School of Electrical Engineering.

# **NOVEL MATERIALS FOR POWER SYSTEMS** Semiannual Technical Report, 1 Jun. - 30 Nov. 1973

R. J. Schwartz, C. A. Angoli, and R. G. Squires Dec. 1973 56 p refs

(Grant DAHC15-73-G0011; ARPA Order 2338)

(AD-771336) Avail: NTIS CSCL 10/2

The second project is aimed at developing an understanding of glassy materials which conduct electricity by the movement of protons through structure. The long range objective of the third research program is to modify the distribution of oxidation states which are stable at the surface of a metal oxide catalyst by controlling the dispersion of the catalyst on its inert support. Preliminary kinetic studies of the oxidation of carbon monoxide. A maximum rate exists at about 3% Cr. There seems to be little, if any, effect of the dispersion on activity at chromium contents less than one percent. (Modified author abstract)

GRA

**N74-17798#** Molecular Energy Corp., Murray Hill, N.J. **CONSTRUCTION OF 850 AND 4,000 AMPERE-HOUR SILVER-ZINC CELLS USING INORGANIC SEPARATOR** Final Report, Jul. 1972 - Oct. 1973

Charles Grun Dec. 1973 32 p

(Contract N00024-73-C-5043)

(AD-771397; MEC-10-73) Avail: NTIS CSCL 10/3

A 30 ampere-hour (A.H.) Silver-Zinc cell using government supplied inorganic separator 3420-25-FM was constructed and cycled for 120 50% cycles. Test results are discussed. Two 850 A.H. cells (NR-1 type) and two 4,000 A.H. (Dolphin type) Silver-Zinc cells were constructed using the inorganic 3420-25-FM separator. Testing of these cells will be carried out by the government for use in submersible vehicles. (Modified author abstract)

GRA

**N74-17799#** Edo Corp., College Point, N.Y. Government Products Div.

# **EXPERIMENTAL REEL RESPONSE SYSTEM FOR HIGH PERFORMANCE SIMPLIFIED AERIAL REFUELING STORE** Final Engineering Report

R. J. Miko, L. Pino, and H. Schwartz Apr. 1973 56 p

(Contract N00019-70-C-0498)

(AD-771389; EDO-9972) Avail: NTIS CSCL 01/2

The report presents the results of a program to verify the feasibility of innovations to a high performance aerial refueling store designed under a previous contract. Operational tests of an experimental hose reel assembly and control system demonstrated the simplicity of system operation and control. The test program demonstrated that the hydrostatic transmission and controls could achieve the desired hose extension, response and retraction accelerations and velocities, and that the hose could be wound onto a 17-inch diameter reel positioned with its axis parallel to the store centerline. Author (GRA)

**N74-17800#** Environmental Protection Agency, Washington, D.C. Office of Research and Monitoring.

# **ENERGY CONSERVATION STRATEGIES**

Marquis R. Seidel, Steven E. Plotkin, and Robert O. Reck Jul. 1973 122 p refs

(PB-224493/7GA; EPA-R5-73-021) Avail: NTIS MF \$1.45; SOD HC \$1.25 as EP1.23/3-73-021 CSCL 21D

Strategies for reducing national energy demands are examined. It is necessary to find out, for each potential energy saving, how much energy is involved and how costly the alternative would be. Many users get much of their energy at relatively low prices, and are thus encouraged to waste it; the economist calls this price distortion, a form of market failure. The study analyzes the kinds of market failure which seem to cause the present energy crisis, the kinds of government action which could rectify these failures, and the likely response of the economy to moderate price increases. Numerous actions, some large and some small, would be required to restore a more efficient functioning of the market for energy. In an efficient market, energy price increases of 25% would prompt a halving of the growth of energy demand; through 1990, energy needs would grow 40% rather than the 100% projected at current prices.

Author (GRA)

**N74-17801#** California Univ., Riverside. Inst. of Geophysics and Planetary Physics.

# **FEASIBILITY STUDY FOR DEVELOPMENT OF HOT-WATER GEOTHERMAL SYSTEMS** Final Technical Report

James B. Combs Mar. 1973 126 p refs

(Grant AF-AFOSR-2393-72; ARPA Order 2184)

(AD-771016; IGPP-UCR-73-18; AFOSR-73-2070TR) Avail: NTIS CSCL 10/2

The investigation has been directed toward a feasibility study for the development of hot-water geothermal systems for potential Department of Defense use as an energy source. The research effort has included the gathering of both scientific and engineering data. The world-wide occurrence of both known and probable sites of hot-water (water-dominated) geothermal systems particularly in relation to United States Department of Defense installations are reviewed and discussed. Included are the geological settings and the types of detection techniques that are necessary to delineate geothermal systems. GRA

**N74-17804#** Energy Research Corp., Bethel, Conn. **HIGH POWERED FLAME HEATED THERMIONIC POWER SOURCE MODULE** Final Report, 1 Jun. 1971 - 1 Jun. 1973

Richard E. Engdahl, Joseph F. Engelberger, and B. S. Baker Dec. 1973 71 p refs

(Contract DAAB07-71-C-0222; DA Proj. 1T7-62705-A-053) (AD-771959; ECOM-0222-F-71) Avail: NTIS CSCL 10/2

Drawing upon technology acquired in the development of a 100 watt flame-heated thermionic diode, the contractor addressed the development effort toward a scale up to 1300 watts. The design concept called for a multiplicity of diodes serially connected in a single module. This was deemed necessary to minimize losses in power extraction and in power conditioning. Accomplishments included fabrication of SiC flame barriers in the size required and development of multiple layer refractory metal and insulation assembly techniques using chemical vapor deposition. (Modified author abstract)

GRA

**N74-17805#** Energy Research Corp., Bethel, Conn. **SECONDARY ZINC-OXYGEN BATTERIES** Final Report, Jun. 1972 - Jun. 1973

M. Klein Nov. 1973 46 p refs

(Contract DAAB07-72-C-0272)

(AD-771961; ECOM-0272-F-72) Avail: NTIS CSCL 10/3

The report describes research and development leading to the construction of a long life high energy density sealed zinc-oxygen secondary battery which is capable of operating over the range of temperatures and rates compatible with Army communications and surveillance equipment. It includes investigations and screening of inorganic separator materials, optimization of the rechargeable zinc electrodes, investigation of various rechargeable oxygen electrode schemes, including bifunctional and monofunctional electrodes, and design, fabrication and testing of a lightweight sealed 6-volt, 25 ampere-hour zinc-oxygen battery. GRA



**N74-17871#** Los Alamos Scientific Lab., N.Mex.  
**SODIUM: CLEAN-ENERGY STORAGE MEDIUM FOR VEHICULAR POWER**  
 W. K. Brown Sep. 1973 10 p refs  
 (Contract W-7405-eng-36)  
 (LA-5406-MS) Avail: NTIS HC \$4.00

Metallic sodium is proposed as an energy storage medium to provide pollution-free power for virtually all forms of land, sea, and air transportation. Ideally, electrical energy from efficient, central, nuclear-powered plants would be used in the reduction of ordinary salt to sodium, which would subsequently be carried in vehicles and reacted with water to produce mechanical energy in a hydrogen-fueled engine. Lye, the sole combustion product, would be recycled for continuing use. The scheme appears to offer a competitive alternative to the use of cryogenic hydrogen for vehicular power. Author (NSA)

**N74-18007#** Eason Oil Co., Oklahoma City, Okla.  
**EVALUATION OF THE SUITABILITY OF SKYLAB DATA FOR THE PURPOSE OF PETROLEUM EXPLORATION** Quarterly Report, Oct. - Dec. 1973  
 Robert J. Collins, Principal Investigator Dec. 1973 4 p EREP  
 (Contract NAS9-13297)  
 (E74-10331; NASA-CR-136842) Avail: NTIS HC \$4.00 CSCL 08G

There are no author-identified significant results in this report.

**N74-18012#** Earth Satellite Corp., Washington, D.C.  
**STUDY OF APPLICATION OF ERTS-A IMAGERY TO FRACTURE-RELATED MINE SAFETY HAZARDS IN THE COAL MINING INDUSTRY** Progress Report, 1 Jan. - 1 Mar. 1974

Charles E. Wier, Frank J. Wobber, Principal Investigators, Orville R. Russell, Roger V. Amato, and Thomas V. Leshendok 26 Feb. 1974 5 p Prepared in cooperation with Indiana Geol. Survey ERTS  
 (Contract NAS5-21795)  
 (E74-10336; NASA-CR-136847) Avail: NTIS HC \$4.00 CSCL 08I

The author has identified the following significant results. The mine refuse inventory maps were prepared in response to a need by both the State and the coal industry. The lack of information on the scope of the problem handicapped all people concerned in drafting realistic legislation for a severance tax on coal production to raise funds for restoration of refuse sites. The inventory was conducted rapidly and economically, and demonstrated the benefits which can be derived through remote sensing methods.

**N74-18073#** Woods Hole Oceanographic Institution, Mass.  
**REVIEW OF THE RESULTS FROM THE EASTERN ATLANTIC CONTINENTAL MARGIN PROGRAM OF THE INTERNATIONAL DECADE OF OCEAN EXPLORATION**

K. O. Emery Oct. 1973 34 p refs  
 (Grant NSF GX-28193)  
 (PB-225036/3GA; WHOI-73-75; WHOI-Contrib-3218) Avail: NTIS HC \$3.75 CSCL 08J

One of the programs of the International Decade of Ocean Exploration is a large geophysical and geological study of the eastern Atlantic continental margin. Excellent results were obtained aboard ship with a computerized system of gravity, magnetics, and seismic reflection and refraction. The cruises mapped large sediment filled basins and belts of salt diapiric structures. Some of the basins and diapiers are the sites of present petroleum production. In addition, small pagoda structures discovered on the deep ocean floor may have some promise as sources for gas. Lastly, areas of coastal upwelling, large river discharge, and open-ocean divergence were outlined as areas being exploited for fish. Author (GRA)

**N74-18184#** RAND Corp., Santa Monica, Calif.  
**PETROLEUM: A PREDICTION MADE IN 1950**  
 James H. Hayes Dec. 1973 11 p refs

(P-5135) Avail: NTIS HC \$4.00 CSCL 11H

An outline of the world petroleum situation as it relates to the United States is presented. The various geographical areas where petroleum is found are examined with emphasis on the longevity of the sources as well as how political situations affect the accessibility of the sources. The need for replacing inaccessible sources by alternate sources and synthetic processes is examined. S.K.W.

**N74-18287#** National Academy of Sciences - National Research Council, Washington, D.C. Committee on Motor Vehicle Emissions.

**NAS REPORT ON TECHNOLOGICAL FEASIBILITY OF 1975-1976 MOTOR VEHICLE EMISSION STANDARDS. A CRITIQUE OF THE 1975-1976 FEDERAL AUTOMOBILE EMISSION STANDARDS FOR HYDROCARBONS AND OXIDES OF NITROGEN**

May 1973 78 p refs  
 (Contract EPA-68-01-0402)  
 (PB-224863/1GA) Avail: NTIS HC \$3.75; HC also available from NTIS \$26.00/set of 8 reports as PB-224866-SET CSCL 13B

This report covers the results of a study, by the Panels on Emission Standards and Atmospheric Chemistry, Committee on Motor Vehicle Emissions, NAS, into the basis for the Federal Motor Vehicle Emission standards for hydrocarbons and oxides of nitrogen for 1975 and later model year vehicles. The study covers the relationship between levels, emission sources, growth factors and computation of emission standards. GRA

**N74-18288#** National Academy of Sciences - National Research Council, Washington, D.C. Committee on Motor Vehicle Emissions.

**NAS REPORT ON TECHNOLOGICAL FEASIBILITY OF 1975-1976 MOTOR VEHICLE EMISSION STANDARDS. AUTOMOTIVE SPARK IGNITION ENGINE EMISSION CONTROL SYSTEMS TO MEET THE REQUIREMENTS OF THE 1970 CLEAN AIR AMENDMENTS**

May 1973 115 p refs  
 (Contract EPA-68-01-0402)  
 (PB-224862/3GA) Avail: NTIS HC \$4.25; HC also available from NTIS \$26.00/set of 8 reports as PB-224866-SET CSCL 13B

This report summarizes the data available on the performance of emission control systems for spark-ignition engines that approach the degree of control required to meet the 1975 and 1976 automobile emission standards as required by the 1970 Clean Air Amendments. Emission control for conventional engines and also unconventional approaches for spark-ignition engines are discussed. The lead time necessary for production is also discussed. GRA

**N74-18289#** National Academy of Sciences - National Research Council, Washington, D.C. Committee on Motor Vehicle Emissions.

**NAS REPORT ON TECHNOLOGICAL FEASIBILITY OF 1975-1976 MOTOR VEHICLE EMISSION STANDARDS. A CRITIQUE OF THE 1975 FEDERAL AUTOMOBILE EMISSION STANDARD FOR CARBON MONOXIDE. NATIONAL ACADEMY OF SCIENCES**

May 1973 70 p refs  
 (Contract EPA-68-01-0402)  
 (PB-224861/5GA) Avail: NTIS HC \$3.50; HC also available from NTIS \$26.00/set of 8 reports as PB-224866-SET CSCL 13B

This report covers the results of a study, by the Panel on Emissions Standards, Committee on Motor Vehicle Emissions, NAS, into the basis for the Federal motor vehicle carbon monoxide emission standard for 1975 and later model year vehicles. The study covers the measurement of ambient CO levels, health effects, growth factors, sources, air quality models and computation of emission standards. GRA

**N74-18291#** National Academy of Sciences - National Research Council, Washington, D.C. Committee on Motor Vehicle Emissions.

**NAS REPORT ON TECHNOLOGICAL FEASIBILITY OF 1975-1976 MOTOR VEHICLE EMISSION STANDARDS Final Report, Jan. 1972 - Feb. 1973**

15 Feb. 1973 156 p refs

(Contract EPA-68-01-0402)

(PB-224858/1GA) Avail: NTIS HC \$4.75; HC also available from NTIS \$26.00/set of 8 reports as PB-224866-SET CSCL 13B

Pursuant to Section 202(c) of the Clean Air Act, the Environmental Protection Agency contracted with the National Academy of Sciences to study the technological feasibility of the 1975-76 Federal Motor Vehicle Emission Standards. This is a report on that study as carried out by the Committee on Motor Vehicle Emissions and covers various topics including test procedures and certification, conventional control technology, alternative engines, in-use emissions and manufacturing, cost and productivity. GRA

**N74-18292#** National Academy of Sciences - National Research Council, Washington, D.C. Committee on Motor Vehicle Emissions.

**NAS REPORT ON TECHNOLOGICAL FEASIBILITIES OF 1975-1976 MOTOR VEHICLE EMISSIONS STANDARDS. MANUFACTURABILITY AND COSTS TO PROPOSED LOW-EMISSION AUTOMOTIVE ENGINE SYSTEMS**

Jan. 1973 81 p refs

(Contract EPA-68-01-0402)

(PB-224864/9GA) Avail: NTIS HC \$3.75; HC also available from NTIS \$26.00 set of 8 reports as PB-224866-SET CSCL 13B

The Panel examined and reported the status of four domestic auto manufacturers' catalyst manufacturers' production plans for 1975-76 emission control system. Also examined was the potential production status of rotary, Diesel, and stratified charge engines. The Panel also provided an estimated resource impact of 1976 emission control systems. GRA

**N74-18294#** Dow Chemical Co., Midland, Mich.

**CHARACTERIZATION OF PARTICULATES AND OTHER NON-REGULATED EMISSIONS FROM MOBILE SOURCES AND THE EFFECTS OF EXHAUST EMISSIONS CONTROL DEVICES ON THESE EMISSIONS**

James E. Gentel, Otto J. Manary, and Joseph C. Valenta Mar. 1973 217 p

(Contract EPA-70-126)

(PB-224243/6GA; APTD-1567) Avail: NTIS HC \$13.00 CSCL 13B

The effect of emission control devices on the particulate emissions of an automotive power plant was investigated. Particulate mass emission rates were measured, as well as particle mass size distribution, carbon and hydrogen, tract metal, and benzo-a-pyrene content of the particulate. Ammonia and aldehydes were measured in the exhaust gas condensate, and gaseous emissions were determined as a routine check on engine operating conditions. GRA

**N74-18300#** Environmental Protection Agency, Research Triangle Park, N.C.

**COMPILATION OF AIR POLLUTANT EMISSION FACTORS (SECOND EDITION)**

Apr. 1973 288 p refs Revised

(PB-223996/OGA; AP-42) Avail: NTIS MF \$1.45; SOD HC \$3.55 as EP4.9:42 CSCL 13B

Emission data obtained from source tests, material balance studies, engineering estimates, etc., have been compiled for use by individuals and groups responsible for conducting air pollution emission inventories. Emission factors given cover most of the common emission categories: fuel combustion by stationary and mobile sources; combustion of solid wastes; evaporation of fuels, solvents, and other volatile substances; various industrial processes; and miscellaneous sources. When no source test data

are available, these factors can be used to estimate the quantities of primary pollutants (particulates, carbon monoxide, sulfur dioxide, nitrogen oxides, and hydrocarbons) being released from a source or source group. Author (GRA)

**N74-18303#** National Academy of Sciences - National Research Council, Washington, D.C. Committee on Motor Vehicle Emissions.

**NAS REPORT ON TECHNOLOGICAL FEASIBILITY OF 1975-1976 MOTOR VEHICLE EMISSIONS STANDARDS. FEASIBILITY OF MEETING THE 1975-1976 EXHAUST EMISSION STANDARDS IN ACTUAL USE**

Jun. 1973 251 p refs

(Contract EPA-68-01-0402)

(PB-224865/6GA) Avail: NTIS HC \$6.25 HC also available from NTIS \$26.00/set of 8 reports as PB-224866-SET CSCL 13B

It is examination of feasibility the panel considered the durability of proposed control systems, deterioration of components and adjustment, contamination of catalysts by fuels and labels, adequacy of the service industry, adequacy of replacement parts, the level of emissions from cars with inoperative control systems, and the availability of state programs for ensuring proper maintenance. The document also contains a Minority Report on analytical investigation of feasibility of meeting the 1975-1976 exhaust emission standards in actual use. GRA

**N74-18304#** Washington Univ., Seattle.

**A CRITICAL REVIEW OF MATHEMATICAL DIFFUSION MODELING TECHNIQUES FOR PREDICTING AIR QUALITY WITH RELATION TO MOTOR VEHICLE TRANSPORTATION Final Report**

Donna V. Lamb, Franklin L. Badgley, and August T. Rossano Jun. 1973 96 p refs Sponsored by Wash. State Dept. of Highways, Olympia

(PB-224656/9GA; RPR-12.1) Avail: NTIS HC \$3.75 CSCL 13B

At the request of the Washington State Department of Highways a literature review was undertaken to assess the State-of-the-art in air quality modeling as related to motor vehicle transportation problems. In addition to reviewing the published literature several private companies and governmental agencies with available models were contacted as were individuals working in the field. Models which were available for review are described and examined with respect to identification of latest State-of-the-art characteristics, model applicability, and limitations. Recommendations on the use of air quality diffusion models are offered. Author (GRA)

**N74-18305#** National Environmental Research Center, Research Triangle Park, N.C. Control Systems Lab.

**ATMOSPHERIC EMISSIONS FROM THE PETROLEUM REFINING INDUSTRY Final Report**

L. L. Laster Aug. 1973 58 p refs

(PB-225040/5GA; EPA-650/2-73-017) Avail: NTIS HC \$3.50 CSCL 07A

This report summarizes the air pollution problems of the petroleum refining industry, with emphasis on gaseous emissions. A general outline of the refining processes, sources and types of pollutant emissions, and present and needed control methods is provided. GRA

**N74-18313#** Esso Research and Engineering Co., Linden, N.J. Government Research Lab.

**POTENTIAL POLLUTANTS IN FOSSIL FUELS**

E. M. Magee, H. J. Hall, and G. M. Varga, Jr. Jun. 1973 292 p refs

(Contract EPA-68-02-0629)

(PB-225039/7GA; GRU-2DJ-73; EPA-R2-73-249) Avail: NTIS HC \$6.50 CSCL 13B

This survey presents the composition of typical U.S. fossil fuels by source location, and the extent to which the selection of coals and crude oils by geographic source can be expected to affect their composition in trace elements. The first section deals with coals produced and consumed in the United States.

A section on petroleum and shale oil includes domestic crudes and crudes from nations which export to this country. The number of elements for which statistical data on composition and geographical location exist is entirely different for crude oil and for coal. Good data and useful correlations with source locations are available for petroleum, for sulfur, nitrogen and nickel/vanadium, but not for other potential pollutants. A large body of data is available for trace elements in coal, and is examined herein. For both coal and petroleum, however, the level of trace elements present is relatively low so that methods of sample selection and sample handling, prior to analysis, can and do present major complications in the interpretation of results. GRA

**N74-18328#** Max-Planck-Institut fuer Plasmaphysik, Garching (West Germany).

**DESIGN STUDY OF SUPERCONDUCTING 5 TESLA DIPOLE MAGNETS FOR MGD GENERATORS**

W. Elsel and H. Muntenbruch Dec. 1972 99 p refs In GERMAN; ENGLISH summary (IPP-IV-53) Avail: AEC Depository Libraries HC \$7.00

A general design concept for a 5 tesla dipole magnet to be used in a 10 MW MHD generator was developed. The solution allows the linear dimensions of the magnet to be increased or decreased by a factor of about 2 without need of major modifications. The required dimensions and properties of the magnet are: rated field strength = 5 tesla; magnetic length = 2 m; uniformity in a volume 50 cm in diameter and about 2 m in length deviations from the rated field strength should be less than 5%; room temperature bore-circular with a diameter of 70 cm or square with sides 60 cm long. The investigations provided the basic calculations and drawings for designing the magnet system, power supply system, cryogenic system and the control and safety facilities. Various conductors, coil geometries, winding concepts, and design principles were compared. The forces in the coils as well as in the structure were calculated and estimates concerning the quench behavior were made.

Author (NSA)

**N74-18403#** Stevens Inst. of Tech., Hoboken, N.J.

**THE HYDROGEN IC ENGINE: ITS ORIGINS AND FUTURE IN THE EMERGING ENERGY-TRANSPORTATION-ENVIRONMENT SYSTEM**

Kurt H. Weil [1973] 9 p refs (Rept-729212) Avail: NTIS HC \$4.00

A historical review of the internal combustion engine is presented. The use of hydrogen based fuels instead of hydrocarbon fuels are discussed as a fuel source for controlling air pollution both in automobiles and in electric utilities. S.K.W.

**N74-18406#** National Academy of Sciences - National Research Council, Washington, D.C. Committee on Motor Vehicle Emissions.

**NAS REPORT ON TECHNOLOGICAL FEASIBILITY OF 1975-1976 MOTOR VEHICLE EMISSION STANDARDS. AN EVALUATION OF ALTERNATIVE POWER SOURCES FOR LOW-EMISSION AUTOMOBILES, NATIONAL ACADEMY OF SCIENCES**

Apr. 1973 161 p refs (Contract EPA-68-01-0402) (PB-224859/9GA) Avail: NTIS HC \$4.75; HC also available from NTIS \$26.00/set of 8 reports as PB-224866-SET CSDL 21E

The panel has evaluated several near and long term alternative power systems including diesel, gas turbine Rankine cycle and Stirling engines. In addition electric vehicles and alternative fuels were studied. Various aspects of each engine-system was considered including emissions, fuel economy, noise, cost size and weight, produceability and driveability. The report also discusses the lead time necessary to begin limited and mass production of each system. GRA

**N74-18407#** National Academy of Sciences - National Research Council, Washington, D.C. Committee on Motor Vehicle Emissions.

**NAS REPORT ON TECHNOLOGICAL FEASIBILITY OF 1975-1976 MOTOR VEHICLE EMISSION STANDARDS. EVALUATION OF CATALYST AS AUTOMOTIVE EXHAUST TREATMENT DEVICES, NATIONAL ACADEMY OF SCIENCES**

Mar. 1973 85 p refs (Contract EPA-68-01-0402) (PB-224860/7GA) Avail: NTIS HC \$3.75 HC also available from NTIS \$26.00/set of 8 reports as PB-224866-SET CSDL 13B

The report covers investigations into the availability of catalyst for oxidation and NOx reduction with sufficient activity and stability, the causes of aging, and the interaction of catalysts with hardware modifications. The report also examines the raw material availability, manufacturing and maintenance problems, and the toxicology of debris. The panel also discusses several remaining problem areas. GRA

**N74-18414#** AiResearch Mfg. Co., Phoenix, Ariz.

**LOW NOx EMISSION COMBUSTOR DEVELOPMENT FOR AUTOMOBILE GAS TURBINE ENGINES Final Report, 11 May 1971 - 30 Nov. 1972**

D. W. Dawson, K. A. Hanson, and R. C. Holder Feb. 1973 273 p refs (Contract EPA-68-04-0014) (PB-225133/8GA; AT-6097-R12; APTD-1374) Avail: NTIS HC \$15.75 CSDL 21E

Thirty-five combustor configurations were tested to determine emission characteristics. Chemical kinetics of emissions formation are discussed. A design technique that achieved significant NOx reductions in a gas turbine combustor was demonstrated. This technique involved the application of recuperator (or regenerator) bypass air directly into the combustor primary zone. The vaporizer combustor resulted in the most significant improvement by the use of bypass flow. The optimum low emissions engine would use an engine cycle and variable bypass flow that have been matched to provide the best balance between fuel economy and related emissions. Variable recuperator bypass is a simple and convenient alternative to variable combustor geometry. The required control system is simpler and has the potential of: lower cost; higher reliability; and better maintainability. GRA

**N74-18417#** Systems Research Labs., Inc., Dayton, Ohio. **INVESTIGATION IN ENERGY TRANSFER AND ENERGY CONVERSION FOR ADVANCED POWER AND PROPULSION SYSTEMS Final Report, 16 Mar. 1970 - 16 Mar. 1973**

C. Calvert and J. Watson Oct. 1973 120 p refs (Contract F33615-70-C-1515; AF Proj. 7116) (AD-771581; ARL-73-0122) Avail: NTIS CSDL 10/2

The report covers the work done in three areas of energy conversion and transfer involving fluid dynamic processes: electrofluiddynamic energy conversion, multicomponent flow research, and aerodynamic energy transfer research. The effort under item one was an exploration of direct energy conversion of fluid dynamic energy into electrical power using electrofluid-dynamic (EFD) processes. The objective here was to identify workable and practical processes and designs for superior, lightweight, reliable, electrical generators. Item two covers studies of methods by which heat energy from reactions of solid particles or droplets contained in a combustion or reaction chamber can be used to produce fluid dynamic energy. The principal objective of this work was to assess wall erosion, particle suspension, and related fluid dynamic processes and components germane to practical thrust augmentation ejectors. The objective was to identify appropriate design concepts applicable to future vertical or short-field take-off-and-landing aircraft. (Modified author abstract) GRA

**N74-18557#** National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.

**LIGHT BULB HEAT EXCHANGER FOR MAGNETOHYDRODYNAMIC GENERATOR APPLICATIONS PRELIMINARY EVALUATION**

J. Marlin Smith, Charles C. Hwang (Pittsburgh Univ.), and George Seikel, R. Washington Mar. 1974 29 p refs

(NASA-TN-D-7534; E-7593) Avail: NTIS HC \$3.25 CSCL 20M

The light-bulb heat-exchanger concept is investigated as a possible means of using a combustion heat source to supply energy to an inert gas MHD power generator system. In this concept, combustion gases flow through a central passage which consists of a duct with transparent walls through which heat is transferred by radiation to a radiation receiver which in turn heats the inert gas by convection. The effects of combustion-gas emissivity, transparent-wall-transmissivity, radiation-receiver emissivity, and the use of fins in the inert gas coolant passage are studied. The results indicate that inert gas outlet temperatures of 2500 K are possible for combustion temperatures of 3200 K and that sufficient energy can be transferred from the combustion gas to reduce its temperature to approximately 2000 K. At this temperature more conventional heat exchangers can be used.

Author

**N74-18582#** Mitre Corp., McLean, Va.

**SYMPOSIUM ON ENERGY, RESOURCES AND THE ENVIRONMENT. VOLUME 1: SESSION ON INTERNATIONAL ISSUES**

12 Apr. 1972 227 p Conf. held at McLean, Va., 12 Apr. 1972 Revised 3 Vol.

(M72-69-Vol-1-Rev-2) Avail: NTIS HC \$14.50

Technological and capital requirements to meet the growing international storage in energy by better and expanded exploitation of resources is discussed. Interwoven aspects of limited growth versus full scale growth societies are considered. For individual titles, see N74-18583 through N74-18590.

**N74-18583** Mitre Corp., McLean, Va.

**INTRODUCTORY REMARKS**

Charles A. Zraket *In its* Symp. on Energy, Resources and the Environment, Vol. 1 12 Apr. 1972 p 1-12

The interrelationships or linkages between economic growth, environmental impact, international problems, and definition of a consensual ethic in the worldwide energy sources development are discussed. It is stipulated that the increasing real costs of energy have a decisive impact on all policies of decision makers and that alternatives need to be developed on research in resource exploration and extraction.

G.G.

**N74-18584** Hudson Inst., Inc., Croton-on-Hudson, N.Y.

**CONTEXT OF THE SESSION THEME, INTERNATIONAL ISSUES**

Robert B. Panero *In Mitre Corp. Symp. on Energy, Resources and the Environment, Vol. 1 12 Apr. 1972 p 13-28*

A study framework is projected that considers the context for international issues on energy demands, energy sources, and environmental values. Various possible prospective views are explored that project growth on resource dependence for various economic areas of the globe.

G.G.

**N74-18585** Massachusetts Inst. of Tech., Cambridge.  
**COMPUTER SIMULATION OF WORLD DYNAMICS AND IMPLICATIONS FOR POLICY DECISIONS**

Jay Forrester *In Mitre Corp. Symp. on Energy, Resources and the Environment, Vol. 1 12 Apr. 1972 p 29-48*

It is stipulated that energy and resource policies are coupled to social issues. The effects of technology in social breakdown are stressed and it is suggested that energy demands should not be fully met for the long term good of society. Instead, the growth rate in the use of energy and resources should be gradually reduced so that demands no longer rise. The inevitable slowing of growth requires adjustment of our system policies on ethics, rightness, and humanitarianism to new concepts of human equality.

G.G.

**N74-18586** Hudson Inst., Inc., Croton-on-Hudson, N.Y.

**ECONOMIC BASIS FOR ENERGY AND RESOURCE USE**  
Herman Kahn *In Mitre Corp. Symp. on Energy, Resources and the Environment, Vol. 1 12 Apr. 1972 p 48-104*

An economic basis for energy and resource use to solve international societal problems in the future is presented. G.G.

**N74-18587** California Univ., Livermore, Lawrence Livermore Lab.

**ENERGY IN GENERAL**

Glenn C. Werth *In Mitre Corp. Symp. on Energy Resources and the Environment, Vol. 1 12 Apr. 1972 p 105-136 refs*

Technical aspects of providing energy and utilizing resources for world-wide demand are considered. Projected energy flow patterns recognize growth demands fossil fuel reserves that require definite economic and technological adjustments. Better utilization of the coal and oil shale resources can be obtained by secondary and tertiary recovery methods such as water flood and fire flood, or nuclear explosions, a move to gasifying coal underground also seems to be feasible. Nuclear breeder reactor development is technically proven but economic feasibility must be considered. Solar energy source developments require storage facilities in principle; hydrogen seems to be the best product to be used as a fuel and possible for transportation markets. Emphasis is placed on making all these fuel resources available at acceptable prices for the world's community.

G.G.

**N74-18588** Mitre Corp., McLean, Va.

**THE INTERNATIONAL ASPECTS OF IMPORTING NATURAL GAS**

Robert A. Charpie *In its* Symp. on Energy, Resources and the Environment, Vol. 1 12 Apr. 1972 p 136-153

Importation of liquefied natural gas from Algeria to eliminate the expected natural gas shortage in the U.S.A. requires the adjustment of regulatory limitations to foreign currencies, the building of cryogenic tankers to transport liquid methane, and the building of terminal facilities in the east coast of the United States.

G.G.

**N74-18589** Massachusetts Inst. of Tech., Cambridge.  
**REMARKS**

Jay Forrester *In Mitre Corp. Symp. on Energy, Resources and the Environment, Vol. 1 12 Apr. 1972 p 154-157*

The question whether or not the required capital will be available if technology did manage to meet energy and resource shortages, mounting pollution, and food shortages, is considered. Solving this real problem by a computer simulation model demands internal consistency between present assumptions and future expectations in technology, sociology, value structures, and long term versus short term conflicts.

G.G.

**N74-18590** Hudson Inst., Inc., Croton-on-Hudson, N.Y.

**REMARKS**

Herman Kahn *In Mitre Corp. Symp. on Energy, Resources and the Environment, Vol. 1 12 Apr. 1972 p 157-170*

World capital requirements to meet energy and resources shortages in 2100 relative to GNP will be about five to one. In order to maintain this projected growth to the year 2100 an accumulation of about two quadrillion dollars worth of capital is necessary. It is stipulated that capital accumulation of five percent a year does not seem to be a problem for the U.S.A.

G.G.

**N74-18591#** Mitre Corp., McLean, Va.

**SYMPOSIUM ON ENERGY, RESOURCES AND THE ENVIRONMENT. SESSION ON ETHICS AND ENVIRONMENTAL ASPECTS OF THE DEMAND FOR AND USE OF ENERGY, VOLUME 2**

13 Apr. 1972 253 p Conf. held at McLean, Va., 13 Apr. 1972 Revised 3 Vol.

(M72-69-Vol-2-Rev-1) Avail: NTIS HC \$15.75

Environmental ethics affect research and development of alternative energy sources as well as the more efficient exploitation of existing resources leading to a more equal distribution of

wealth and the socioeconomic burden in a population.

**N74-18592** Virginia Univ., Charlottesville.

# **NATIONAL ENERGY POLICIES**

Fred Singer *In* Mitre Corp. Symp. on Energy, Resources and the Environment, Vol. 2 13 Apr. 1972 p 2-27

It is stressed that socioeconomic considerations require the development of abundant and low cost energy in a national policy. The energy should be environmental clean and reasonable self-sufficient to insure long term national security. Public policies and regulations and a lead agency are required to assume these responsibilities and to fund the various sources of energy exploration. G.G.

**N74-18593** California Univ., Livermore. Lawrence Livermore Lab.

# **AN ENERGY ETHIC**

Marvin R. Gustavson *In* Mitre Corp. Symp. on Energy, Resources and the Environment, Vol. 2 13 Apr. 1972 p 28-67

The development of a consensual energy ethic is projected that leads to public agreement as to what is fair in respect to the various aspects of source development. Key issues are: Source development -- particularly of fossil fuel; energy use -- as affected by education, advertising, and legislation; (3) nationalism -- in the national security sense as seen by a citizen of a consuming nation; (4) pollution -- as a negative factor in the quality of life; (5) Federal funding -- as an element of public support; and (6) fusion reactors -- as an example of a possible technological key to abundant energy. G.G.

**N74-18594** Mitre Corp., McLean, Va.

# **ISSUES INVOLVED IN DEVELOPING AN ENVIRONMENTAL ETHIC**

S. David Freeman *In* its Symp. on Energy, Resources and the Environment, Vol. 2 13 Apr. 1972 p 68-89

Issues involved in developing energy and environmental ethics rest on a basic collision of values between a society that is built on an abundant supply of energy and a society that has adopted an environmental concern. It is shown that the U.S. consumes thirty to thirty-five percent of the world's resources each year with six percent of the world's population and that the rest of the world is two-thirds in a perpetual blackout. A policy of conservation and saving, and a more even distribution of the world's resources necessitates inherent redistribution of wealth until research and development efforts produce more environmentally compatible sources of energy. G.G.

**N74-18595** Mitre Corp., McLean, Va.

# **ENVIRONMENTAL ISSUES AND INSTITUTIONAL ARRANGEMENTS**

John F. OLeary *In* its Symp. on Energy, Resources and the Environment, Vol. 2 13 Apr. 1972 p 90-135

A comprehensive set of energy, resource and environmental issues is presented. Some changes to governmental institutions for dealing with the energy crisis are described that encompass pricing, depletion allowances, oil imports, and environmental regulations. G.G.

**N74-18596** Harvard Univ., Cambridge, Mass.

# **MECHANISMS FOR ACHIEVING CLEANER POWER, PRICES, REGULATIONS**

Marc Roberts *In* Mitre Corp. Symp. on Energy, Resources and the Environment, Vol. 2 13 Apr. 1972 p 136-187

The following three policy mechanisms to achieve cleaner power are appraised: prices, regulation, and direct public provision. It is shown that the resource-environmental-energy linkup at the current level of pollution is due to multiplicative interaction of the amount of output per capita, the number of people, and the amount of pollution per unit output. The need for shifting some

of the distribution impact of the projected financing burden from the poor population is emphasized. G.G.

**N74-18597** Mitre Corp., McLean, Va.

# **ENVIRONMENTAL ISSUES, AN OVERVIEW**

Richard S. Greeley *In* its Symp. on Energy, Resources and the Environment, Vol. 2 13 Apr. 1972 p 188-208

The environmental issues discussed are: (1) Waste heat and its effect on temperature of the earth; (2) air pollution by soot, sulfur and auto emissions; (3) radioactivity in catastrophic accident and local release, at background levels, and in the forever problem; (4) power plant and industrial facility siting; (5) strip and open pit mining; (6) offshore exploration and drilling; (7) wilderness and remote area exploitation; and (8) zero growth projection. It is concluded that in the long run the conservation of energy in order to conserve the environment cannot be overlooked and that research and development to find alternative resources will increase the energy cost factor markedly. G.G.

**N74-18598#** Mitre Corp., McLean, Va.

# **SYMPOSIUM ON ENERGY, RESOURCES AND THE ENVIRONMENT. VOLUME 3: SESSION ON OPTIONS FOR THE FUTURE AND THEIR RESOURCES, ECONOMIC, AND ENVIRONMENTAL EFFECTS**

14 Apr. 1972 9198 p refs Conf. held at McLean, Va. 14 Apr. 1972 Revised 3 Vol.

(M72-69-Vol-3-Rev-1) Avail: NTIS HC \$13.00

Energy demands and sources are considered and economic and environmental aspects of future resource developments are discussed. For individual titles, see N74-18599 through N74-18604.

**N74-18599** Atomic Energy Commission, Washington, D.C.

# **ENERGY OPTIONS FOR THE FUTURE**

Clarence E. Larson *In* Mitre Corp. Symp. on Energy, Resources, and the Environment, Vol. 3 14 Apr. 1972 p 1-20

New technologies in energy conversion and new energy resources are considered that range from electric cars, solar energy conversion, magnetohydrodynamic power, geothermal energy, and nuclear fusion processes. The dominant role of the liquid metal cooled breeder reactor for providing future energy is emphasized. G.G.

**N74-18600** Institute of Energy Economics of Japan.

# **ENERGY DEMAND IN JAPAN, 1975 TO 1985**

Masao Sakisaka *In* Mitre Corp. Symp. on Energy, Resources and the Environment, Vol. 3 14 Apr. 1972 p 20-31

The outlook on Japanese demand for energy and supplies for meeting this demand until 1985 is discussed. Indigenous sources of energy will meet only seven percent of the total energy demand; this necessitates the development of electric nuclear power plants in Japan and of uranium resources in overseas countries. Disposal of radioactive wastes poses a serious environmental problem. G.G.

**N74-18602** Citizens' Advisory Committee on Environmental Quality, Washington, D.C.

# **MAJOR R&D PROGRAMS TO MEET THE ENERGY CRISIS**

Lelan F. Sillin, Jr. *In* Mitre Corp. Symp. on Energy, Resources and the Environment, Vol. 3 14 Apr. 1972 p 68-80 ref

The review of restrictive environmental protection laws and regulations is advocated in order to construct and operate new power facilities that insure increased electric energy demands for future economic growth in the U.S. Long term payoffs for society require power supply systems which produce and transmit abundant, reliable and cheap power without depletion of natural resources. Research on the use of solar energy, fusion power, large scale production of hydrogen, or an optimum blending of several of these concepts is projected for future energy supply systems. G.G.

**N74-18603** Sierra Club, Washington, D.C. Energy Policy Committee.

# **MAN VERSUS HIS INSTITUTIONS**

Keith Roberts *In* Mitre Corp. Symp. on Energy, Resources and the Environment, Vol. 3 14 Apr. 1972 p 83-109 ref

The goals of a rational energy policy encompass: (1) limitation of total energy consumption to those amounts necessary for a quality of life compatible with the carrying capacity of the environment; (2) use of a combination of energy sources for maximum efficiency; (3) minimization of ecological disruption, aesthetic harm, or damage to human and animal health; (4) public policy making procedures to achieve above goals; and (5) elimination of undue special interest propaganda based on one-sided facts. G.G.

**N74-18604** Office of Science and Technology, Washington, D.C.

# **ENERGY OPTIONS**

Richard E. Balzhiser *In* Mitre Corp. Symp. on Energy, Resources and the Environment, Vol. 3 14 Apr. 1972 p 109-129.

Technological options to solving the energy problem constitute development of the liquid metal gas breeder reactor to produce nuclear energy; coal gasification to produce a synthetic natural gas; and SO<sub>2</sub> removal technology from stack gases to permit high sulfur coal burning. Fusion, solar, and geothermal energies are prime candidates for supplementing above primary needs. Author

**N74-18605#** Committee on Aeronautical and Space Sciences (U. S. Senate).

# **ENERGY-RELATED RESEARCH AND DEVELOPMENT**

Washington GPO Mar. 1974 95 p refs Presented to Comm. on Aeron. and Space Sci., 93d Congr., 2nd Sess., Mar. 1974 Prepared by NASA, Washington, D. C. Avail: SOD HC \$1.00

Technology developed for space and aeronautics has useful applications to energy needs and problems on earth. The specific research and development projects include work in solar energy utilization, including wind energy systems; energy conversion, transmission and storage; transportation systems; and energy and environment conservation. Programs in aeronautics and space which are directly relevant to energy include remote sensing applied to energy resources, fuel conservation in aeronautics, energy conversion and storage, and space and nuclear technology. The transfer to the private sector of aeronautical and space technology applicable to energy needs is another way in which significant contributions are made in energy research and development. Author

**N74-18606#** RAND Corp., Santa Monica, Calif.

# **THE POTENTIAL FOR ENERGY CONSERVATION IN COMMERCIAL AIR TRANSPORT**

James J. Mutch Oct. 1973 90 p refs (Grant NSF GI-44) (R-1360-NSF) Avail: NTIS HC \$7.50

The potential is examined for reducing the energy requirements of the U.S. commercial airlines, with emphasis on the certificated-route air carriers. Measures stressed are independent of the level of traffic demand. They are intended to reduce energy requirements by decreasing the energy intensity of air transport. The possibility is examined of substituting more efficient transport modes for aviation in short-haul routes and the attendant net energy savings is assessed. Measures that yield benefits in both the short and long term are considered and their conservation potentials are quantified relative to present and future energy requirements. The results should be of interest to those involved in airline activities, including governmental regulatory and policymaking bodies, industry groups, and the airlines themselves. Author

**N74-18607#** RAND Corp., Santa Monica, Calif.

# **TRANSPORTATION ENERGY USE IN THE UNITED STATES: A STATISTICAL HISTORY, 1955 - 1971**

James J. Mutch Dec. 1973 54 p refs

(Grant NSF GI-44)

(R-1391-NSF) Avail: NTIS HC \$5.75

Total transportation energy consumption is considered in view of increased travel per person and an increasing use of more energy intensive modes. Energy distribution for modes and markets is shown from 55 to 71 in graphical form. Freight and passenger transportation on highways, aircraft, railroads, and waterways are also reviewed. J.A.M.

**N74-18609#** United Nations, New York. Economic and Social Council.

# **NATURAL RESOURCES DEVELOPMENT AND POLICIES INCLUDING ENVIRONMENTAL CONSIDERATIONS. ADDENDUM: CHANGING PATTERNS IN THE WORLD ENERGY SITUATION**

12 Jan. 1971 40 p refs

(E/C.7/2/Add.1) Avail: NTIS HC \$5.00

The consumption and production of energy worldwide are cited. Special attention was given to the close interrelationship between energy use and economic development. Energy demand as affected by industrialization, urbanization, and mechanization are discussed. Statistical tables covering consumption and energy supplies from 1950 to 1968 are included. E.H.W.

**N74-18610#** Cranfield Inst. of Technology (England).

# **THE ASSESSMENT OF AN AIR-SUPPORTED AND PROPELLED URBAN TRANSPORT SYSTEM Final Report**

Roger Slevin Dec. 1972 115 p refs

(Cranfield-CTS-1) Avail: NTIS HC \$8.75

The results are reported of a one-year study intended to assess the usefulness of a new transport technology; that of an urban air-supported and propelled system. The technology is described and its qualitative and quantitative assessment is reported in both absolute and comparative terms. It is concluded that the proposed system has several features which make its application unlikely; in particular there are safety problems, and there is no positive evidence that overall costs would be lower than existing competing modes in conventional circumstances. As a result it is not recommended that any further development of the technology should take place. The report is written as an account of the work undertaken. In this way it provides a guide to the process for future studies of this type. Author

**N74-18622#** Committee on Interior and Insular Affairs (U. S. Senate).

# **ENERGY CONSERVATION AND S. 2176, PART 2**

Washington GPO 1973 845 p refs Hearing on S. 2176 before Comm. on Interior and Insular Affairs, 93d Congr., 1st Sess. 1 Aug. 1973

Avail: Comm. on Interior and Insular Affairs

Hearings are reported describing the role of energy conservation in national energy policy. Conservation in transportation, housing, and in the industrial sector are emphasized. Ways to educate consumers to use energy more efficiently especially regarding motor vehicles and home appliances are outlined. S.K.W.

**N74-18623#** Decision Sciences Corp., Jenkintown, Pa.

# **QUANTITATIVE ENERGY STUDIES AND MODELS: A STATE OF THE ART REVIEW**

Dilip R. Limaye, Robert Ciliano, and John R. Sharbo [1973] 50 p refs Sponsored by Council on Environmental Quality. In that demonstration can be applied to several areas of technology. Even if there is uncertainty about some of the underlying data, military goods and services should be expressed in terms that uniformly reflect Soviet rather than U.S. manufacturing methods and input quantities. Author (GRA)

**N74-18633#** Transportation Systems Center, Cambridge, Mass.

# **ENERGY STATISTICS: A SUPPLEMENT TO THE SUMMARY OF NATIONAL TRANSPORTATION STATISTICS Final Report, Jun. - Jul. 1973**

Gill V. Hicks Sep. 1973 94 p refs

(PB-225331/8GA; DOT-TSC-OST-73-34)

Avail: NTIS

**HC \$3.75 CSCL 05C**

The report is a compendium of selected time series data describing the transportation, promotion, processing, and consumption of energy. The report is divided into three main sections. The first contains such items as the revenues and expenses of oil pipeline companies, number and capacities of U.S. tank ships, and the total crude oil transported in the U.S. by methods of transportation. The second section reveals the growth over time of the U.S. oil and natural gas reserves, refinery capacity, and yields. Trends in demand for fuel and power are displayed in the third section. Throughout this part, the transportation sector is emphasized. Included are the gasoline and oil costs of automobiles of different sizes, the consumption of petroleum by type of product, the energy intensiveness of the air carriers, the electrical energy consumed by the local transit industry, and other important statistics describing the supply and demand for energy. GRA

**N74-18634#** Kentucky Univ., Lexington. Coll. of Engineering. **PROCEEDINGS: ENERGY RESOURCE CONFERENCE (2ND)**

Aug. 1973 59 p. Conf. held at Lexington, Ky., 24-25 Oct. 1972

(PB-224750/OGA; UKY-TR-70-73-CEED4) Avail: NTIS HC \$5.00 CSCL 10A

Recent available information on the rapidly changing energy resource picture, fuel policies and consumer demands is presented. Papers by knowledgeable government officials and industrial representatives are included. Topics covered include new developments in the extraction of natural gas and crude oil, interfuel conversion (coal to gas and oil, coal to gas by the Lurgi process, SNG and oil), the role of the Federal Government to insure an adequate, reliable energy supply, and the transmission and transportation of energy. GRA

**N74-18638#** Defense Documentation Center, Alexandria, Va. **ENERGY CONVERSION Report Bibliography, Jan. 1974 - Aug. 1973**

Jan. 1974 409 p. refs

(AD-771750; DDC-TAS-74-2) Avail: NTIS CSCL 10/2

The bibliography is a compilation of 287 references on Energy Conversion. Citations are sequenced numerically within each of the following categories: (1) Fuel Cells; (2) Mineral Fuels; (3) Nuclear Energy; (4) Solar Energy; (5) Steam Power; (6) Thermionic Generators; (7) Thermoelectric Generators; (8) Geopolitical Energy Studies; and (9) Miscellaneous Studies. Corporate Author-Monitoring Agency, Subject, Title, Personal Author, Contract Number, and Report Number Indexes are included.

Author (GRA)

**N74-18720** Tulane Univ., New Orleans, La. **INVESTIGATION OF ENERGY CONVERSION IN RAPIDLY CYCLING FUEL CELLS. 1. A SYSTEM FOR STUDYING THE SURFACE DIFFUSION OF HYDROGEN ON METALS, 2 Ph.D. Thesis**

Vasudev Dayanand Prabhu 1973 268 p

Avail: Univ. Microfilms Order No. 74-320

By rapidly cycling the fuel cell, energy conversion techniques can be applied to design a mechanical device called an electrochemical pump. The cycle efficiency and performance of the electrochemical pump is studied by means of transient fuel cell and electrolysis operation of the ion exchange membrane fuel cell. Performance characteristics of the cell during rapid cycling operation are presented and critically analyzed. A system for experimentally measuring surface diffusion is designed and constructed. The surface diffusion of tritium can be obtained by monitoring the radioactivity of adsorbed tritium versus distance along a metal surface with the help of a low energy beta detector. A critical analysis of results in terms of energies of tritium and noise level encountered during experiments is presented.

Dissert. Abstr.

**N74-18721#** Georgia Inst. of Tech., Atlanta. School of Mechanical Engineering. **COMPARATIVE EVALUATION OF SOLAR, FISSION, FUSION, AND FOSSIL ENERGY RESOURCES. PART 1:**

**SOLAR ENERGY Final Report**

J. R. Williams 23 Jan. 1974 122 p. refs

(Grant NGR-11-002-166)

(NASA-CR-137242) Avail: NTIS HC \$9.25 CSCL 10A

The utilization of solar energy to meet the energy needs of the U.S. is discussed. Topics discussed include: availability of solar energy, solar energy collectors, heating for houses and buildings, solar water heater, electric power generation, and ocean thermal power. F.O.S.

**N74-18723#** Joint Publications Research Service, Arlington, Va.

**THERMAL CYCLE AND EFFICIENCY OF A VERSATILE POWER UNIT WITH A MAGNETOHYDRODYNAMIC GENERATOR AND THERMOELECTRIC GENERATOR**

V. A. Kirillin, A. Ye. Sheyndlin, Ye. M. Shelkov, Ye. V. Shishkov, S. A. Pashkov, and V. M. Latyshev 1 Mar. 1974 8 p. refs Transl. into ENGLISH from Teplofiz. Vysokikh Temperatur, Akad. Nauk SSSR (Moscow), v. 11, no. 5, 1973 p 1088-1091

(JPRS-61359) Avail: NTIS HC \$4.00

A MHD generator circuit is described with an overload mode capacity making operation possible in a wide range of loads.

Author

**N74-18724#** National Bureau of Standards, Washington, D.C. Building Environment Div.

**TECHNICAL OPTIONS FOR ENERGY CONSERVATION IN BUILDINGS Final Report**

Jul. 1973 186 p. refs Prepared for Natl. Conf. of States on Building Codes and Standards and NBS Joint Emergency Workshop on Energy Conserv. in Buildings, Washington, D. C., 19 Jun. 1973

(NBS-TN-789) Avail: SOD HC \$2.35 Domestic Postpaid or \$2.00 GPO Bookstore as C13.46:789

Actions pertinent to existing buildings and new buildings are described. Regarding existing buildings, principal topics include summer cooling, winter heating, and other energy conserving features--i.e., insulation, fenestration, lighting, appliances, domestic hot water, and human comfort. Suggested actions include those which can be accomplished voluntarily or without expense, and also actions which require some modest effort or expense on the part of the building owner or occupant. Regarding new buildings, energy conservation actions are described that deal with building design and mechanical systems. The report concludes with a summary of mechanisms for implementation of such actions and criteria for use in evaluation of them. Author

**N74-18725#** Union Electric Co., St. Louis, Mo. **RECYCLING SOLID WASTE FOR UTILITY FUEL AND RECOVERY OF OTHER RESOURCES**

Earl K. Dille and David L. Klum 1973 17 p. refs Presented at 1973 Frontiers of Power Technol., Stillwater, Okla. Sponsored by City of St. Louis

Avail: NTIS HC \$4.00

Full scale prototype testing to determine the feasibility of processing municipal solid waste to produce supplementary fuel for electric utility boilers and to recover recyclable, non-combustible materials has been conducted. Operation of the prototype was satisfactory during the first year with the exception of milled solid waste mechanical handling problems. Crushed glass in the solid waste resulted in excessive wear and maintenance of solid waste pneumatic transport piping bends and elbows. Metals and oversize pieces of wood caused frequent stoppages of solid waste transport system mechanical feeding equipment. The mechanical handling problems were identified soon after the initial operation and it appeared clear that the material presented no other operating problems at the processing plant or in furnace combustion. Consequently, engineering design and purchase of a mechanical air separator (air classifier) was initiated to provide for the removal of glass, metals, and other unburnable materials. Author

**N74-18727#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

**COMPUTER PROGRAM FOR THERMODYNAMIC ANALYSIS**

# OF OPEN CYCLE MULTISHAFT POWER SYSTEM WITH MULTIPLE REHEAT AND INTERCOOL

Arthur J. Glassman Washington Mar. 1974 86 p ref  
(NASA-TN-D-7589; E-7518) Avail: NTIS HC \$3.75 CSCL 10A

A computer program to analyze power systems having any number of shafts up to a maximum of five is presented. On each shaft there can be as many as five compressors and five turbines, along with any specified number of intervening intercoolers and reheaters. A recuperator can be included. Turbine coolant flow can be accounted for. Any fuel consisting entirely of hydrogen and/or carbon can be used. The program is valid for maximum temperatures up to about 2000 K (3600 R). The system description, the analysis method, a detailed explanation of program input and output including an illustrative example, a dictionary of program variables, and the program listing are explained. Author

N74-18728# Los Alamos Scientific Lab., N.Mex.  
**AND WHAT IF WE WERE TO SWITCH TO HYDROGEN?**  
Yu. Medvedev and E. Muslin 1973 25 p Transl. into ENGLISH from Izobret. Izobret. i Ratsionalizatsiya, Irkutsk (Irkutsk), no. 318, 1973 p 40-44  
(LA-TR-73-40) Avail: NTIS HC \$3.25

The use of ordinary water as a fuel source from which to derive hydrogen is proposed. The production of hydrogen by the reactions of the Mark-1 process and the process with iron-carbon catalysts is discussed. The pipelines and transport of hydrogen with its applications to fuel sources or everyday life are discussed. It is predicted that it will be possible to establish a powerful food chain depending neither on agriculture nor on oil reserves and based only on atomic energy. Scientists have been trying, with the aid of hydrogen yeast to obtain food from carbon dioxide, mineral salts, and hydrogen obtained with electrolysis of water by current from solar batteries. The same hydrogen and oxygen could serve as an energy source for fuel cells. Author (NSA)

N74-18730# Electricity Commission of New South Wales, Sydney (Australia).

## ELECTRICITY: THE CONVERSION INDUSTRY

N. B. Heal 1973 10 p refs  
(NP-19837) Avail: AEC Depository Libraries HC \$3.00

Planning of future electric power supplies is considered with specific reference to Australia. Topics covered include fuel reserves, fuel costs, electricity supply today, planning future supplies, energy transport, and the effect of changes on the consumer. Coal, uranium, and possibly natural gas coal reserves are clearly adequate to provide a supply of fuel at reasonable costs for power generation for well into the next century. In comparison with uranium and coal, known reserves of crude oil and natural gas in Australia are relatively small. NSA

## N74-18731# Atomic Energy Commission, Washington, D.C. PROCESS FOR THE SIMULTANEOUS UTILIZATION OF GEOTHERMIC AND HYDRODYNAMIC ENERGY

J. E. Tavip [1974] 7 p Transl. into ENGLISH from the Spanish  
(AEC TR-7475) Avail: NTIS HC \$3.00

A process is described for the utilization of hydrodynamic energy produced by water falling through a pipe inserted deeply into the earth's crust at a point where the high temperature will produce steam and is returned to the earth surface through another pipe as steam. The waterfall created by this perforation is utilized by turbines suitable for the production of electric energy while the steam produced spurts from the surface of the earth and can be used as a source of energy with multiple applications. NSA

## N74-18737# Energy Research Corp., Bethel, Conn. HIGH ENERGY SEALED NICKEL-ZINC BATTERIES Final Annual Report, 1 Mar. 1972 - 1 Oct. 1973

Allen Charkey Nov. 1973 44 p  
(Contract DAA807-72-C-0114; DA Proj. 1T7-62705-A-053) (AD-772944; ECOM-0114-F) Avail: NTIS CSCL 10/3

A sealed 7 Ah/6.5 volt nickel-zinc battery has been developed

which is capable of 180-200 cycles of operation at approximately 80% depth of discharge at the C/4 rate. Initial energy density obtained was 28 Wh/lb at the C/4 discharge rate. The battery will deliver about 40% of its energy at -20F at the C/4 rate. With silver amalgam oxygen recombination electrodes the battery is capable of continuous overcharge at 0.5 amperes at a safe steady state pressure below 50 psi. Improved inorganic separators (ERC-2002) have been developed which are chemically inert in KOH, have a uniform pore size distribution and stop the occurrence of zinc dendrites. The primary cause of failure of the battery was found to be from the zinc electrode failure. (Modified author abstract) GRA

N74-18738# Army Electronics Command, Fort Monmouth, N.J.

## ZINC-AIR (OXYGEN) CELL STUDIES

Otto C. Wagner Nov. 1973 20 p refs  
(DA Proj. 1T7-62705-A-053)

(AD-772903; ECOM-4166) Avail: NTIS CSCL 10/3

Shorting by zinc penetration through the separator layers was prevented in zinc-air and zinc-oxygen cells by inserting a 10 mil thick partially wetproofed porous nickel layer within the layers of separator material. Excellent capacity maintenance was attained for 50 cycles from a zinc-air cell by: (a) containing the zinc anode within a plastic frame onto which the separator layers were epoxy-sealed, (b) blocking the edges of the anode with a thin plastic shield, and (c) providing a 20 to 30 mil thick electrolyte channel between the charging electrodes and separator clad anode. Preliminary results from sealed zinc-oxygen cell investigations indicate that good capacity maintenance can be attained by: (a) sealing the charging electrode within a plastic frame onto which a layer of potassium titanate paper is epoxy-sealed, to the edge of the electrolyte face and a thin porous teflon layer is cemented to the gas face, (b) using silver-amalgam catalyzed oxygen electrodes, and (c) adding 5% potassium titanate powder to the zinc oxide mix. Author (GRA)

## N74-18815# Bureau of Mines, Washington, D.C. ENERGY POTENTIAL FROM ORGANIC WASTES: A REVIEW OF THE QUANTITIES AND SOURCES

Larry L. Anderson 1972 19 p refs  
(BM-IC-8549) Avail: SOD HC \$3.30

The quantities and sources of moisture- and ash-free organic material contained in manure, urban refuse, industrial wastes, sewage solids, and agricultural wastes in the United States are itemized and evaluated. Furthermore, estimates are presented for amounts of organic wastes collected or concentrated. The potential for fuel, either oil or gas, from both the total organic wastes generated and those collected or concentrated is also estimated. Author

## N74-18888 Duke Univ., Durham, N.C. PERFORMANCE CHARACTERISTICS OF A PNEUMATIC TUBE TRANSPORTATION SYSTEM Ph.D. Thesis

Joseph John Cudlin 1973 182 p  
Avail: Univ. Microfilms Order No. 74-1129

The limitations and deficiencies of the conventional models of ground transportation have prompted the proposal of a number of innovative high speed systems for future urban and interurban mass transit. Those which appear to offer the most desirable operating characteristics are systems which utilize an enclosed guideway. The power requirements for high speed ground transportation are, however, potentially high. Since the power required for propulsion of surface vehicles at higher speeds is largely that needed to overcome aerodynamic drag, enclosed guideway systems, operated at reduced internal pressures, are proposed to offer a more practical means for high speed ground transportation. A pneumatic tube transportation system would propel carrier vehicles through tube guideways by the combined effects of continuous evacuation of the guideway length ahead of the vehicle and the admission of air at a higher pressure to the guideway behind the vehicle. Dissert. Abstr.

N74-18892# Cranfield Inst. of Technology (England). Centre for Transport Studies.



(NRL Proj. R02-33)

(AD-772530; NRL-7615) Avail: NTIS CSCL 09/5

A conformal array on a surface of small curvature can be approximated by a number of planar arrays, several of which may be excited simultaneously so as to achieve a performance similar to that of a conformal array. Since the main beam of a planar array can be steered to any direction in visible space, several arrays, each oriented in a different direction, can be steered cooperatively to form a single beam in a desired direction. A general formulation of the radiated field of such a configuration of arrays is developed with the aid of formulas which relate the components into which a vector is resolved in one orthogonal coordinate system with those into which the same vector is resolved in a second orthogonal coordinate system. (Modified author abstract) GRA

N74-18897# Southwest Research Inst., San Antonio, Tex. Army Fuels and Lubricants Research Lab.

# **INSTALLATION OF TURBINE-FUELS RESEARCH COMBUSTOR LABORATORY Final Report**

C. A. Moses Dec. 1973 28 p

(Contract DAAD05-70-C-0007)

(AD-772945; AFLRL-27) Avail: NTIS CSCL 21/4

A laboratory especially designed for the study of fuel-related problems in the operation of turbine engines has been installed at the U.S. Army Fuels and Lubricants Research Laboratory. The air supply system provides a clean, smooth flow of air to the combustion test cell at rates up to 2.5 lbs/sec; pressures to 16 atm and temperatures to 1500F are possible at all flow rates. The fuel delivery system is capable of pumping fuels ranging in properties from gasoline to No. 5 diesel at flow rates of over 1 gpm and pressures over 1000 psi. Up to 50 channels of thermocouple and transducer signals are sampled; the data reduction is performed on-line with test results available immediately. The system has been designed for maximum flexibility and growth. Conceivably, any combustion chamber and associated rig can be plugged-in, instrumented, and operated within the air flow capabilities of the laboratory. Author (GRA)

N74-19047# Sandia Labs., Albuquerque, N.Mex.

# **FRACTURE OF COAL AND OIL SHALE FOR IN SITU PROCESSING OR REMOTE REMOVAL: A PROPOSAL SUPPORT DOCUMENT**

L. D. Tyler and W. D. Weart Oct. 1973 17 p refs

(Contract AT(29-1)-789)

(SLA-73-946) Avail: NTIS HC \$3.00

The proposal sets forth the concept of using the synergistic effects of a combination of hydraulic and explosive techniques to fracture these formations in a controlled manner.

Author (NSA)

N74-19113 Central Electricity Generating Board, London (England).

# **BEARINGS FOR POWER STATION PLANT. A SELECTIVE BIBLIOGRAPHY, 1960 - SEPTEMBER 1973**

E. F. Hansford, comp. Feb. 1974 26 p refs

(CE-Bib-288.1) Avail: Issuing Activity

Selected abstracts of 108 articles concerning research on bearings are presented. Areas reported include materials, lubrications, vibration, and failure. F.O.S.

N74-19117# Bureau of Mines, Morgantown, W.Va. Energy Research Center.

# **NONCAKING COAL GASIFIED IN A STIRRED-BED PRODUCER Technical Progress Report**

R. V. Rahfuss, G. B. Goff, and A. J. Liberatore Mar. 1974 11 p refs

(BM-TPR-77) Avail: NTIS HC \$4.00

Noncaking O- by 2-inch subbituminous A coal from New Mexico was gasified with air and steam at 205 psig using a stirred-bed producer to determine coal losses by entrainment in the gas for this low sulfur, high ash coal which contained 20 percent particles smaller than 1/16-inch sieve size. The use of fine sized coal has particular importance because most production

from mechanized mines is smaller than 2-inch size. This initial attempt showed technical feasibility for gasifying New Mexico subbituminous coal containing small sized particles in fixed-bed producers without excessive coal loss by entrainment. Dust loss averaged about 2 percent of moisture free coal, most of which was recovered from the gas. Ash clinkering was controlled by adding 1,010 lb/hr steam to reduce temperatures in the combustion zone. Yield of low-Btu fuel gas, 150 Btu per scf, dry, amounted to 69,800 scfh from 1,490 lb/hr coal (as received) and 3,450 lb/hr air (dry). Author

N74-19228 Environmental Protection Agency, Research Triangle Park, N.C. Air Pollution Technical Information Center.

# **AIR POLLUTION ASPECTS OF EMISSION SOURCES: PETROLEUM REFINERIES: A BIBLIOGRAPHY WITH ABSTRACTS**

Jul. 1972 73 p refs

(AP-110) Avail: SOD HC \$1.25

Selected abstracts are presented of articles concerning air pollution by petroleum refineries. Subject and author indexes are included. Author

N74-19229 California Inst. of Tech., Pasadena.

# **DETERMINATION OF OPTIMAL AIR POLLUTION CONTROL STRATEGIES Ph.D. Thesis**

Chan Pein Kywan 1 Apr. 1974 213 p

Avail: Univ. Microfilms Order No. 73-31047

One of the important environmental problems facing urban officials today is the selection and enforcement of air pollutant emission control measures. These measures take two forms: long-term controls (multiyear legislation, such as the Federal new car emission standards through 1976) and short-term controls (action taken over a period of hours to days to avoid an air pollution episode). For the long-term control problem, it is assumed that emission control procedures are changed on a year-to-year basis. The problem considered is to determine the set of control measures that minimizes the total cost of control while maintaining specified levels of air quality each year. The problem of determining real-time (short-term) air pollution control strategies for an urban airshed is posed as selecting those control measures such that air quality is maintained at a certain level over a given time period and the total control imposed is a minimum.

Dissert. Abstr.

N74-19240# National Academy of Sciences - National Research Council, Washington, D.C.

# **REPORT BY THE COMMITTEE ON MOTOR VEHICLE EMISSIONS**

15 Feb. 1973 155 p

Avail: NTIS HC \$10.75

The technological feasibility of meeting the motor vehicle emissions standards prescribed by law was investigated. The design, performance, and costs of emission control systems are discussed along with the standards, certification and testing. The potential of spark-ignition internal-combustion engines for passing emission certification for 1975 is analyzed. F.O.S.

N74-19268# TRW Systems Group, Redondo Beach, Calif.

# **A STUDY OF MANDATORY ENGINE MAINTENANCE FOR REDUCING VEHICLE EXHAUST EMISSIONS. VOLUME 7: A USER'S MANUAL AND GUIDE TO THE ECONOMIC EFFECTIVENESS COMPUTER PROGRAM Final Report**

Jul. 1973 385 p refs Sponsored by EPA and Coordinating Res. Council, Inc. 8 Vol.

(PB-225161/9GA; CRC-APRAC-CAPE-13-68-15-Vol-7) Avail: NTIS HC \$8.00 CSCL 13B

This manual presents a detailed description of the Economic Effectiveness Computer program. The program provides a generalized methodology for simulating the dynamic behavior of alternative vehicle inspection and maintenance procedures. The model has been coded in FORTRAN 4 and is currently operating on a CRC 6500 System. The manual describes for the programmer/user the operating instructions required to use the program in a variety of operating modes. It is composed of five sections and two appendices which provide a discussion of the model's

mathematical framework, input requirements and data formats, program debugging and output options, and a complete list of flow schematics and computer listings. GRA

**N74-19269#** TRW Systems, San Bernardino, Calif. Transportation and Environmental Operations.  
**A STUDY OF MANDATORY ENGINE MAINTENANCE FOR REDUCING VEHICLE EXHAUST EMISSIONS. VOLUME 8: EXPERIMENTAL CHARACTERIZATION OF VEHICLE EMISSIONS AND MAINTENANCE STATES** Final Report Jul. 1973 203 p refs Sponsored by EPA and Coordinating Res. Council, Inc. '8 Vol. (PB-225026/4GA; CRC-APRAC-CAPE-13-68-16-Vol-8) Avail: NTIS HC \$5.50 CSCL 13B

Data are presented which describe the rate of engine adjustment and exhaust emission deterioration with time and mileage. Three classes of vehicles are described which include pre 1966 cars without exhaust emission controls, 1966-1970 cars with HC and CO exhaust controls and post 1970 cars that are equipped to control HC, CO and NOx. The results of additional experiments to determine the repeatability of emissions measurements and the effect of cold soak temperature upon measured exhaust emission are also presented. Mass emission measurements were made using the 1972 Federal Test Procedure and concentration measurements were made in selected engine operation modes. GRA

**N74-19280#** Flinders Univ., Bedford Park (Australia). School of Physical Sciences.  
**CONTROLLED FUSION RESEARCH** Progress Report M. H. Brennan Sep. 1973 21 p refs (FUPH-G-4) Avail: AEC Depository Libraries HC \$3.25

The current status of the international research program directed towards developing a fusion reactor for electricity production is assessed. Information is obtained mainly from meetings of the International Fusion Research Council (July 29 and Aug. 1, 1973) and the Sixth European Conference on Controlled Fusion and Plasma Physics held in Moscow from July 30 to August 3, 1973. The major items of business discussed at the meeting of the International Fusion Research Council are presented and the various national research programs are outlined. Finally, the Australian program is considered. NSA

**N74-19375#** Los Alamos Scientific Lab., N.Mex.  
**DESIGN OPTIONS AND TRADEOFFS IN SUPERCONDUCTING MAGNETIC ENERGY STORAGE WITH IRREVERSIBLE SWITCHING**  
 H. L. Laquer, J. D. G. Lindsay, E. M. Little, J. D. Rogers, and D. M. Weldon 1973 21 p refs Presented at Symp. on Technol. of Controlled Thermonucl. Fusion Expt. and the Eng. Aspects of Fusion Reactors, Austin, Tex., 20 Nov. 1973 Sponsored by AEC (LA-UR-73-910; Conf-731102-1) Avail: NTIS HC \$3.25

A program is presently under way at Los Alamos to determine how superconducting magnetic energy storage in conjunction with normal-going superconducting switches can be made to deliver the energies of the order of 200 MJ that will be needed for plasma compression in a pulsed theta-pinch scientific feasibility experiment. After a review of the circuit configurations, the properties of commercially available and of some developmental superconductors relevant to both the energy storage coil and to the switch are discussed. Critical current densities at low fields and stability requirements both with respect to rapidly changing external fields and to self fields are of particular importance in determining optimum operating fields and temperatures. The tradeoff between eddy current losses in the stabilizing material and the need for coil protection if a coil normalcy should occur is described. Problems in potting or other forms of mechanical stabilization for both superconducting elements are pointed out. Author (NSA)

**N74-19391#** Michigan Univ., Ann Arbor. Dept. of Physics.  
**LIQUID HYDROGEN AS A FUEL FOR MOTOR VEHICLES; A COMPARISON WITH OTHER SYSTEMS**

Lawrence W. Jones [1973] 4 p  
 Avail: NTIS HC \$4.00

The pros and cons are explored of liquid hydrogen fuel, especially for smaller systems (automobiles and trucks). The alternative methods of liquid hydrogen fueling, whether by replaceable tanks or pumping from a storage vessel, are also discussed. Author

**N74-19405#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.  
**A SIMPLIFIED LIFE-CYCLE COST COMPARISON OF VARIOUS ENGINES FOR SMALL HELICOPTER USE**  
 Kestutis C. Civinskas and Laurence M. Fishbach Feb. 1974 29 p refs Prepared in cooperation with Army Air Mobility R and D Lab., Cleveland, Ohio (NASA-TM-X-71517; E-7908) Avail: NTIS HC \$4.50 CSCL 21A

A ten-year, life-cycle cost comparison is made of the following engines for small helicopter use: (1) simple turboshaft; (2) regenerative turboshaft; (3) compression-ignition reciprocator; (4) spark-ignited rotary; and (5) spark-ignited reciprocator. Based on a simplified analysis and somewhat approximate data, the simple turboshaft engine apparently has the lowest costs for mission times up to just under 2 hours. At 2 hours and above, the regenerative turboshaft appears promising. The reciprocating and rotary engines are less attractive, requiring from 10 percent to 80 percent more aircraft to have the same total payload capability as a given number of turbine powered craft. A nomogram was developed for estimating total costs of engines not covered in this study. Author

**N74-19408#** Army Foreign Science and Technology Center, Charlottesville, Va.  
**MULTIFUEL DIESEL ENGINES**  
 I. I. Gershman and A. P. Lebedinskiy 30 Oct. 1973 221 p refs Transl. into ENGLISH of the book "Mnogotoplivnyye Dizeli" Moscow, Mashinost., 1971 224 p (AD-771198/9GA; FSTC-HT-23-1981-72) Avail: NTIS HC \$13.25 CSCL 21/7

Soviet research and development in the field of creating multifuel motor vehicle diesel engines is described. Possible technical solutions directed at adapting the internal combustion engine to operation on various types of fuels are considered. GRA

**N74-19413#** Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.  
**BY-PASS ENGINES**  
 G. Predtechenskii 30 Nov. 1973 14 p Transl. into ENGLISH from Grazhdanskaya Aviats. (USSR), no. 6, Jun. 1973 p 24-25 (AD-772723; FTD-HT-23-537-74) Avail: NTIS CSCL 21/5  
 The report describes the design and performance of Soviet designed jet aircraft bypass engines. GRA

**N74-19584#** National Aeronautics and Space Administration. Pasadena Office, Calif.  
**METHOD OF FORMING A WICK FOR A HEAT PIPE** Patent Application  
 Frank G. Arcella (Westinghouse Elec. Corp.), Ernest C. Phillips (Westinghouse Elec. Corp.), and Richard P. Spreccace, inventors (to NASA) (Westinghouse Elec. Corp.) Filed 27 Feb. 1974 10 p Prepared for JPL (Contracts NAS7-100; JPL-953074) (NASA-Case-NPO-13391-1; US-Patent-Appl-SN-446567) Avail: NTIS HC \$4.00 CSCL 20M

A method for forming a tubular wick for heat pipes is presented. The method consists of steps involving forming the wick blank of a predetermined thickness from multiple layers of stainless steel screen mesh. The process makes it possible to reduce the pore size of the wicks by approximately fifty percent. NASA

**N74-19586#** Federal Power Commission, Washington, D.C. Planning and Development Div.

**NATURAL GAS SUPPLY IN THE DECADE OF THE SEVENTIES**

Gordon K. Zareski Mar. 1973 19 p. refs Presented at the 74th Natl. Meeting of the Am. Inst. of Chem. Engr., New Orleans, 13 Mar. 1973

Avail: NTIS HC \$4.00

The energy situation with respect to natural gas as an energy source was studied. Factors which contributed to the current shortage of natural gas supplied are analyzed. Federal actions to develop the policies necessary to increase the supply of natural gas and to encourage optimum use of this energy source are reported. Possible future sources of natural gas to supplement the shortage are identified. Tables, maps, and graphs are included to show the natural gas supply. P.N.F.

**N74-19587#** Federal Power Commission, Washington, D.C. Analysis and Procedures Div.

**NATURAL GAS AVAILABILITY: PRESENT AND FUTURE**  
Gordon K. Zareski May 1972 13 p. Presented at Symp. on Gaseous Fueled Vehicles and the Environ., Washington, D. C., 24-26 May 1972

Avail: NTIS HC \$4.00

An analysis of the availability of natural gas and gas reserves in the United States is presented. The actual and projected demand for gas during the 1950 to 1990 time period is analyzed. Historical trends in natural gas production and reserve additions are illustrated. A graph of the annual demand for natural gas is plotted to show the levels of domestic productive capacity with annual reserve additions of 30, 25, and 20 trillion cubic feet. P.N.F.

**N74-19604#** Committee on Science and Astronautics (U. S. House).

**H.R. 11864: SOLAR HEATING AND COOLING DEMONSTRATION ACT OF 1974. BACKGROUND AND LEGISLATIVE HISTORY**

Washington GPO Feb. 1974 306 p. refs Presented to Comm. on Sci. and Astronaut., 93d Congr., 2d Sess., Feb. 1974

Avail: NTIS Avail: Subcomm. on Energy

The responses are reported of selected Federal agencies to requests, by the Committee, for information on current research in areas of solar energy. The nature of ongoing solar energy research, funding levels, and recommended areas for development are discussed. The legislative history of solar energy for heating and cooling, H.R. 11864 is included. F.O.S.

**N74-19805#** Select Committee on Small Business (U. S. House).

**CONCENTRATION BY COMPETING RAW FUEL INDUSTRIES IN THE ENERGY MARKET AND ITS IMPACT ON SMALL BUSINESS. VOLUME 2: TENNESSEE VALLEY AREA**

Washington GPO 1972 20 p. Presented by Select Comm. on Small Business to the Comm. of the Whole House on the State of the Union, 92d Congr., 2d Sess., 8 Aug. 1972

(H-Rept-92-1313) Avail: U.S. Capitol, House Document Room

Hearings investigated the monopolistic impact of the growing economic concentration in the energy field and the reasons underlying the recent increases in electric rates in the Tennessee Valley Area. Electric rates have increased 25% and coal prices have risen 100% between 1971-72. Findings and recommendations concerning the causes and solutions to the escalating energy costs are included. K.M.M.

**N74-19808#** Joint Committee on Atomic Energy (U. S. Congress).

**ATOMIC ENERGY COMMISSION 1 DECEMBER 1973 REPORT ON ENERGY RESEARCH AND DEVELOPMENT**

Washington GPO 1974 783 p. refs Hearing before Joint Comm. on Atomic Energy, 93d Congr., 1st Sess., 11 Dec. 1973

Avail: SOD HC \$5.20

Congressional reports on future energy research and development programs are presented. Policies to regain and maintain national energy self-sufficiency are outlined: (1) the

conservation of energy by decreasing consumption and increasing the technical efficiency of conversion processes; (2) increase the domestic production of oil and natural gas; (3) increase the use of coal; (4) expand the production of nuclear energy; and (5) promote the use of alternate energy sources such as hydro, geothermal, and solar. S.K.W.

**N74-19614#** Geological Survey, Washington, D.C.

**ENERGY RESOURCES OF THE UNITED STATES**

P. K. Theobald, S. P. Schweinfurth, and D. C. Duncan 1972 30 p. refs

(Circ-650) Avail: NTIS HC \$4.50

Diagrams present the U.S. Geological Survey estimates of the United States resources of coal, petroleum liquids, natural gas, uranium, geothermal energy, and oil from oil shale. The short text accompanying each diagram outlines the method of estimation or the source of the estimate and defines the characteristics of each estimate. Where appropriate, comparisons with other estimates are also given. Author

**N74-19615#** Mitre Corp., McLean, Va.

**ENERGY, RESOURCES AND THE ENVIRONMENT: A SET OF PRESENTATIONS**

Richard S. Greeley Jun. 1973 79 p. Presented at the US Inform. Agency Exhibit on Progr. and the Environ., Poland Intern. Trade Fair, Lodz, 18-22 Jun. 1973

(M73-61) Avail: NTIS HC \$7.00

The fuel resources available to the world are described, including solar, nuclear fusion, nuclear fission, geothermal, tidal, hydro, and fossil energy sources. These resources are compared with estimated fuel consumption rates in the future. Solar, fusion, and fission with breeding are shown to represent essentially infinite energy sources. Methods are described for improving the efficiency and economy in the ways we use fuels. Savings of 10-15% appear possible in the near term. An energy ethic is described which involves changes to government regulations and tax policies and other institutions to promote efficiency and conservation in the use of fuels. The technology of advanced energy systems is described including automobile engines, mass transit systems, pollution control devices, fuel cells, and magnetohydrodynamic production of electricity. The need for a vigorous, international research and development program is discussed to provide assurance for continued supplies of clean, abundant energy. Author

**N74-19617#** Committee on Commerce (U. S. Senate).

**COUNCIL ON ENERGY POLICY**

Washington GPO 1973 225 p. refs Hearings on S. 70 and S. 419 before Comm. on Com., 93d Congr., 1st Sess., 7-8 Feb. 1973

Avail: Comm. on Com.

Hearings on the establishment of a national energy resources advisory board are presented. Measures to coordinate energy policies and improve management of energy resources are outlined. S.K.W.

**N74-19618#** Committee on Interior and Insular Affairs (U. S. Senate).

**THE GASOLINE SHORTAGE: A NATIONAL PERSPECTIVE**

David M. Lindahl Washington GPO 1973 98 p. refs Presented to Comm. on Interior and Insular Affairs, 93d Congr., 1st Sess., 19 Jun. 1973 Prepared by Library of Congr.

Avail: Comm. on Interior and Insular Affairs

An overview is presented of factors contributing to the gasoline shortage, the extent of the shortage, and its impact on the country. Emphasis is placed upon problems of supply and demand and remedial actions taken to alleviate the problem. Author

**N74-19624#** Mitre Corp., McLean, Va. Transportation Systems Engineering Dept.

**US TRANSPORTATION: SOME ENERGY AND ENVIRONMENTAL CONSIDERATIONS**

W. E. Fraize Sep. 1974 49 p. refs

(M72-164) Avail: NTIS HC \$5.50

The role of transportation in air pollution and consumption of energy, especially petroleum, is reviewed, with emphasis on the U. S. situation. Both technological and control measures for each problem area are discussed. Technological measures focus on the automobile, high speed ground transportation modes, and non-petroleum fuels, while control measures, which encourage the use of the more efficient transportation modes, are seen to offer significant benefits. The near future is discussed with respect to the impact of the U. S. Amended Clean Air Act of 1970. Transportation evolution over the next few decades is projected.

Author

**N74-19629#** Stanford Research Inst., Menlo Park, Calif.  
**MEETING CALIFORNIA'S ENERGY REQUIREMENTS, 1975-2000**

May 1973 412 p refs Sponsored by Los Angeles Dept. of Water and Power, Pacific Gas and Elec. Co., Sacramento Municipal Utility District, San Diego Gas and Elec. Co., and Southern Calif. Edison Co.

(SRI Proj. ECC-2355)

Avail: NTIS HC \$23.75

A study was conducted to determine various aspects of the present and future energy requirements for the State of California. The specific objectives of the study are as follows: (1) to assess the economic framework and related demand for energy, (2) to determine means for altering the projected demand pattern, requirements for implementing each of these demands, and appraisal of their significance, (3) to analyze the future supply from each source of energy and the factors affecting availability and use, and (4) to predict probable future trends in price.

Author

**N74-19693\*** National Aeronautics and Space Administration, Pasadena Office, Calif.

**STORAGE BATTERY COMPRISING NEGATIVE PLATES OF A WEDGE SHAPED CONFIGURATION Patent**

Richard S. Bogner (ESB, Inc., Raleigh, N. C.) and Charles D. Farris, inventors (to NASA) (ESB, Inc., Raleigh, N. C.) Issued 5 Feb. 1974 6 p Filed 22 Feb. 1972 Supersedes N72-22048 (10 - 13, p 1695) Sponsored by NASA Prepared for JPL (NASA-Case-NPO-11806-1; US-Patent-3,790,409; US-Patent-Appl-SN-228163; US-Patent-Class-136-20; US-Patent-Class-136-30) Avail: US Patent Office CSCL 10C

An improved silver-zinc battery particularly suited for use in an environment where battery operation is subjected to multiple charge/discharge cycling over extended periods is described. The battery separator system, containing a highly absorbent material contiguous with the surfaces of the plates and multiple semi-permeable membranes interposed between the plates, is also characterized. Official Gazette of the U.S. Patent Office

**N74-19694** Escher Technology Associates, St. Johns, Mich.  
**A PROBLEM STATEMENT: OCEAN BASED SOLAR-TO-HYDROGEN ENERGY CONVERSION MACRO SYSTEM**

William J. D. Escher and Joe A. Hanson (Oceanic Inst.) Nov. 1973 25 p refs

Copyright. Avail: Issuing Activity CSCL 10A

An ocean based solar to hydrogen energy conversion facility is proposed that uses hydrogen as an energy carrier to be delivered to the spectrum of the energy using sector, instead of electricity, because of hydrogen's advantages of transportability and storability. The solar to hydrogen conversion process is conducted on the open ocean, and not in the traditional desert location. A number of coproducts that can also be supplied by the proposed ocean complex includes sea foods, salts, fertilizers, magnesium, and aluminum materials.

Author

**N74-19695** Oregon State Univ., Corvallis.  
**OPTIMIZATION OF STAGED RANKINE ENERGY CONVERSION CYCLES FOR HIGH EFFICIENCY Ph.D. Thesis**

Larry Dean Simmons 1974 183 p

Avail: Univ. Microfilms Order No. 74-4206

The potential of staged Rankine cycle systems for substantially higher efficiency was studied. It was necessary to optimize the cycles to determine maximum potential efficiency, and the

sequential unconstrained minimization technique of nonlinear programming was implemented on the CDC 3300 computer for this purpose. Binary, ternary, and quaternary Rankine cycle configurations were optimized for maximum efficiency under a set of realistic constraints. Liquid metal working fluids were used for the higher temperature stages with water for the low temperature stage fluid. Maximum efficiencies are presented for the best cycle configurations with peak temperatures from 900 F to 3000 F. Sensitivity of the results to certain critical assumptions is also included. Dissert. Abstr.

**N74-19696\*** Florida Univ., Gainesville. Engineering and Industrial Experiment Station.

**MASS TRANSFER IN FUEL CELLS Semiannual report, 1 Mar - 31 Aug. 1973**

Robert D. Walker, Jr. 14 Dec. 1973 93 p refs

(Grant NGL-10-005-022)

(NASA-CR-137359; SAR-16) Avail: NTIS HC \$7.75 CSCL 10B

Developments in the following areas are reported: surface area and pore size distribution in electrolyte matrices, electron microscopy of electrolyte matrices, surface tension of KOH solutions, water transport in fuel cells, and effectiveness factors for fuel cell components.

Author

**N74-19697\*** National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.

**NASA LEWIS H2-O2 MHD PROGRAM**

Marlin Smith, L. D. Nichols, and G. R. Seikel 10 Apr. 1974 8 p refs Presented at the 14th Symp. on Eng. Aspects of Magnetohydrodynamics, Tullahoma, Tenn., 8-10 Apr. 1974 • (NASA-TM-X-71520; E-7907) Avail: NTIS HC \$4.00 CSCL 10A

Performance and power costs of H2-O2 combustion powered steam-MHD central power systems are estimated. Hydrogen gas is assumed to be transmitted by pipe from a remote coal gasifier into the city and converted to electricity in a steam MHD plant having an integral gaseous oxygen plant. These steam MHD systems appear to offer an attractive alternative to both in-city clean fueled conventional steam power plants and to remote coal fired power plants with underground electric transmission into the city. Status and plans are outlined for an experimental evaluation of H2-O2 combustion-driven MHD power generators at NASA Lewis Research Center.

Author

**N74-19698\*** Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

**OPTICAL PROPERTIES OF THIN GOLD FILMS APPLIED TO SCHOTTKY BARRIER SOLAR CELLS**

Y. -C. M. Yeh 15 Mar. 1974 22 p refs

(Contract NAS7-100)

(NASA-CR-137981; JPL-TM-33-676) Avail: NTIS HC \$4.25 CSCL 10A

The Schottky barrier solar cell is considered a possible candidate for converting solar to electrical energy both for space and terrestrial applications. Knowledge of the optical constants of the ultrathin metal film used in the cell is essential for analyzing and designing higher efficiency Schottky barrier cells. The optical constants of 7.5 -nm (75-A) gold films on gallium arsenide have been obtained. In addition, the absolute collection efficiency of Schottky barrier solar cells has been determined from measured spectral response and optical constants of the gold film. Author

**N74-19699#** City of St. Louis, Mo.  
**ENERGY RECOVERY FROM WASTE: SOLID WASTE AS SUPPLEMENTARY FUEL IN POWER PLANT BOILERS Interim Report**

Robert A. Lowe 1973 29 p refs

(Grant EPA-S-802255)

(SW-36d.ii; IR-2) Avail: SOD HC \$0.40

The process of converting municipal solid waste into energy for power plant boilers is described. The process involves collecting the waste from residential areas, grinding the material, and air-classifying the shredded wastes to find the light combustible fraction. Magnetic metals are recovered from the heavier, mostly noncombustible, wastes. Other topics of discussion include: the

processing system and its operation; boiler modification and operating experience; air pollution considerations; markets; and economics. K.M.M.

**N74-19700\*** National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

**A PANEL FOR SELECTIVELY ABSORBING SOLAR THERMAL ENERGY AND THE METHOD FOR MANUFACTURING THE PANEL** Patent Application

James R. Lowery, inventor (to NASA) Filed 5 Apr. 1974 21 p

(NASA-Case-MFS-22562-1; US-Patent-Appl-SN-458484) Avail: NTIS HC \$4.25 CSCL 10A

A panel for selectively absorbing solar thermal energy is reported that consists of a metallic substrate, a layer of bright metallic material carried on the substrate, and a solar thermal energy absorbing coating carried on the bright metallic material. A layer of zinc is interposed between the metal substrate and the layer of bright material, or the metallic substrate can be anodized for receiving the layer of bright metallic material. Also disclosed is the method for producing the coating which selectively absorbs solar thermal energy. NASA

**N74-19701\*** National Aeronautics and Space Administration. Pasadena Office, Calif.

**HEAT OPERATED CRYOGENIC ELECTRICAL GENERATOR** Patent Application

Taylor G. Wang (JPL), Melvin M. Saffre, and Daniel D. Elleman, inventors (to NASA) Filed 1 Apr. 1974 19 p

(Contract NAS7-100) (NASA-Case-NPO-13303-1; US-Patent-Appl-SN-457295) Avail: NTIS HC \$4.00 CSCL 10A

An electrical generator useful for providing electrical power in deep space, is disclosed. The generator utilizes liquid helium conversion to and from a superfluid state to cause opposite directions of rotary motion for a rotor cell to move a magnetic field provided by a changed superconductive coil mounted on the exterior of the cell. An electrical conductor interacts with the moving magnetic field provided by the superconductive coil and thereby generates electrical energy. A heat control arrangement causes the liquid helium to be partially converted to and from a superfluid state. NASA

**N74-19702\*** National Aeronautics and Space Administration. Pasadena Office, Calif.

**ELECTRIC POWER GENERATION SYSTEM DIRECTLY FROM LASER POWER** Patent Application

Katsunori Shimada, inventor (to NASA) (JPL) Filed 27 Mar. 1974 17 p

(Contract NAS7-100) (NASA-Case-NPO-13308-1; US-Patent-Appl-SN-455164) Avail: NTIS HC \$4.00 CSCL 10A

A system is reported in which laser power is directly converted into electric power. Liquid cesium is ionized by a laser beam with a collector spaced apart from the cesium to collect either the cesium ions or free electrons; thus, a potential difference between the collector and the cesium liquid is produced. NASA

**N74-19705\*** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

**STATUS OF WIND-ENERGY CONVERSION**

Robert L. Thomas and Joseph M. Savino 1973 9 p refs Presented at the RANN Symp., Washington, D. C., 18-20 Nov. 1973; sponsored by NSF

(NASA-TM-X-71523; E-7912) Avail: NTIS HC \$4.00 CSCL 10A

The utilization of wind energy is technically feasible as evidenced by the many past demonstrations of wind generators. The cost of energy from the wind has been high compared to fossil fuel systems; a sustained development effort is needed to obtain economical systems. The variability of the wind makes it an unreliable source on a short term basis. However, the effects of this variability can be reduced by storage systems or connecting wind generators to: (1) fossil fuel systems; (2) hydroelectric systems; or (3) dispersing them throughout a large grid

network. Wind energy appears to have the potential to meet a significant amount of our energy needs. Author

**N74-19706\*** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

**CLEAN FUELS FROM BIOMASS**

Y. Y. Hsu 1974 23 p refs Presented at the 10th Southeastern Seminar on Thermal Sci., New Orleans, 11-12 Apr. 1974

(NASA-TM-X-71538; E-7945) Avail: NTIS HC \$4.25 CSCL 20M

The feasibility of converting biomass to portable fuels is studied. Since plants synthesize biomass from H<sub>2</sub>O and CO<sub>2</sub> with the help of solar energy, the conversion methods of pyrolysis, anaerobic fermentation, and hydrogenation are considered. Cost reduction methods and cost effectiveness are emphasized. G.G.

**N74-19707\*** Kanner (Leo) Associates, Redwood City, Calif. **SYNCHRONOUS-FLOW GENERATOR**

S. V. Zwegbergk Washington NASA Apr. 1974 8 p Transl. into ENGLISH of "Synkronlode-Generator", Chalmers Tech. Univ., Inst. for the Study of Elec. Machinery, Goteborg, Sweden, 16 Jan. 1974 2 p

(Contract NASw-2481) (NASA-TT-F-15440) Avail: NTIS HC \$4.00 CSCL 10A

A synchronous flow generator is described. The results obtained from an investigation into direct frequency reversal with the aid of semiconductors have been used as a basis for designing a synchronous-flow generator. Its uses are foreseen as reserve power plants for hospitals, power supplies on large ships, etc. Author

**N74-19708\*** Kanner (Leo) Associates, Redwood City, Calif. **ANALYSIS OF THE POSSIBLE USE OF WIND POWER IN SWEDEN. PART 1: WIND POWER RESOURCES, THEORY OF WIND-POWER MACHINES, PRELIMINARY MODEL 1 AND 10 MW WIND GENERATORS**

Bengt Soedergard Washington NASA Apr. 1974 55 p refs Transl. into ENGLISH of "Utradning om Vindkraftens Moegligheter i Sverige. Etapp 1: Vindkraftresurser - Teori foer Vindkraftmaskiner - Preliminaera Vindgeneratormopeller 1 och 10 MW", Swed. Board for Tech. Develop., report, 18 Dec. 1973 44 p

(Contract NASw-2481) (NASA-TT-F-15441) Avail: NTIS HC \$5.75 CSCL 10A

Aspects are discussed that must be considered in respect to the possible use of wind power in Sweden, such as availability and nature of wind resources, cost of this type of energy, etc. The basic theory of calculating the power of wind-power machine are presented with tables and diagrams. Data for several large wind-power machines constructed in the U.S.A., Great Britain, etc are given. The conclusion is reached that the use of wind power in Sweden is not feasible, primarily because of its high cost per kWh. Author

**N74-19709\*** Scientific Translation Service, Santa Barbara, Calif.

**HIGH WIND POWER PLANTS**

H. Honnel Washington NASA Apr. 1974 19 p refs Transl. into ENGLISH from Elektrotech. Maschinenbau (Berlin), v. 57, no. 41 and 42, 13 Oct. 1939 p 501-506

(Contract NASw-2483) (NASA-TT-F-15444) Avail: NTIS HC \$4.00 CSCL 10A

In comparison to the usual power plants in which the machines are installed in special buildings, the high wind power plant is described as a power source in which the structure as a whole makes up the machine. New large structures are supports for generators with large diameters but with the other dimensions small. The use of the advantageous high wind flow leads to unusually high structures, but these are completely storm safe and stable, as well as economical. Details of the counter-rotating turbine and some experimental results are presented. Author

**N74-19710\*** Kanner (Leo) Associates, Redwood City, Calif. **REPORT OF THE WIND POWER COMMITTEE OF 1962**

E. Volmer Nielsen Washington NASA Apr. 1974 32 p Transl.

into ENGLISH of "Uddrag af Vindkraftudvalgets Betenknning af 1962", Danish Assoc. of Elec. Supply Undertakings, report, 1962 26 p

(Contract NASw-2481)

(NASA-TT-F-15442) Avail: NTIS HC \$4.75 CSCL 10B

The Danish Wind Power Committee's experiments with propeller windmills are described, specifically the 25-m-high windmill at Gedser. Wind measuring stations were established, and the wind energy available and optimum locations determined. A cost comparison was made of electricity from wind and steam power, and the committee concluded that wind power plants were economically unfeasible to develop at that time. Author

N74-19711# Chicago Univ., Ill.

# **SOLAR CONCENTRATORS OF A NOVEL DESIGN**

Roland Winston Mar. 1974 25 p refs

(EPI-74-21) Avail: NTIS HC \$4.25 CSCL 10A

A new principle for collecting and concentrating solar energy, the ideal cylindrical light collector has been invented. The collector is a trough-like reflecting wall light channel of a specific shape which concentrates radiant energy by the maximum amount allowed by phase space conservation. The ideal cylindrical light collector is capable of accepting solar radiation over an average 8-hour day and concentrating it by a factor of approximately 10 without diurnal tracking of the sun. This collector has a large acceptance for diffuse light. In fact, the efficiency for collecting and concentrating isotropic radiation, in comparison with a flat plate collector, is just the reciprocal of the concentration factor. Author

N74-19717# Naval Ship Research and Development Center, Annapolis, Md.

# **PROCEEDINGS OF WORKSHOP ON NAVY ALTERNATE ENERGY SOURCES RESEARCH AND DEVELOPMENT**

J. R. Belt, ed. and H. V. Nutt, ed. Jan. 1974 97 p refs Conf. held at Annapolis, 18-20 Sep. 1973

(AD-773746; NSRDC-4195) Avail: NTIS CSCL 21/4

A workshop was held to examine the Navy's energy requirements and the directions that Navy Research and Development should take to minimize the impact on the Navy of projected national petroleum fuel supply shortages. The current state of research and development on liquid fuels from coal and oil shale, as well as the ability to extract from them fuels that are reasonably similar to currently used petroleum products, make it appropriate for the Navy to concentrate first on these. Demonstrations of compatibility of Navy power plants with fuels derived from coal or oil shale, and definition of minimum fuel quality requirements, are needed. For the longer term, efforts to harness environmental energy sources, such as winds, currents, and thermal gradients in the earth and in the oceans, appear to have considerable potential payoff, particularly for nonmobile applications. (Modified author abstract) GRA

N74-19975# Interior Dept., Washington, D.C.

# **FINAL ENVIRONMENTAL STATEMENT FOR THE GEOTHERMAL LEASING PROGRAM. VOLUME 2: LEASING OF GEOTHERMAL RESOURCES IN THREE CALIFORNIA AREAS**

1973 517 p refs 4 Vol.

Avail: SOD HC \$5.85

Individual environmental statements are presented for the leasing of federally owned geothermal resources for development in three specific areas: (1) Clear Lake geysers; (2) Mono Lake-Long Valley; and (3) Imperial Valley. Also included is a summary of comments and responses relative to the draft environmental impact statement issued in 1971. Author

N74-19976# Interior Dept., Washington, D.C.

# **FINAL ENVIRONMENTAL STATEMENT FOR THE GEOTHERMAL LEASING PROGRAM. VOLUME 3: PROPOSED GEOTHERMAL LEASING AND OPERATING REGULATIONS**

1973 697 p refs 4 Vol.

Avail: SOD HC \$5.60

Proposed leasing and operating regulations to implement the Geothermal Steam Act are presented. Included are a study comparing vapor dominated hydrothermal systems with hot water systems, and a classification of public lands valuable for geothermal steam and associated geothermal resources. G.G.

N74-19977# Interior Dept., Washington, D.C.

# **FINAL ENVIRONMENTAL STATEMENT FOR THE GEOTHERMAL LEASING PROGRAM. VOLUME 4: COMMENTS ON DRAFT IMPACT STATEMENT AND PROPOSED REGULATIONS**

1973 726 p refs 4 Vol.

Avail: SOD HC \$5.65

Comments received from Federal, State, local, and individual interests on the leasing and operating regulations, the draft environmental impact statement for the Geothermal Leasing Program, and the supplement to the draft statement are presented. Author

N74-20069# Bureau of Mines, Bartlesville, Okla. Energy Research Center.

# **WASTE LUBRICATING OIL RESEARCH: AN INVESTIGATION OF SEVERAL RE-REFINING METHODS**

M. L. Whisman, J. W. Goetzinger, and F. O. Cotton 1974 29 p refs

(BM-RI-7884) Avail: NTIS HC \$4.50

Several commercial processes for reclaiming used lubricating oil were duplicated on a laboratory bench scale. Laboratory tests were selected and in some instances modified to determine the physical properties of each oil produced. In addition, the hydrocarbon composition of some samples was determined using a liquid chromatographic technique, and compared with the composition of new oil in order to determine the severity of the re-refining additive package for further estimates of quality as determined by wear, corrosion, foaming, and oxidation stability tests. Additionally, several samples of commercially re-refined oil and new oil were obtained and physical properties were determined for comparative studies. Author

N74-20238# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.

# **DEVELOPMENT CONCEPT FOR A SMALL SPLIT-CORE, HEAT-PIPE-COOLED NUCLEAR REACTOR**

Edward Lantz, Roland Breitwieser, and George F. Niederauer Washington Apr. 1974 35 p refs

(NASA-TM-X-2996; E-7542) Avail: NTIS HC \$3.25 CSCL 18K

There have been two main deterrents to the development of semiportable nuclear reactors. One is the high development costs; the other is the inability to satisfy with assurance the questions of operational safety. This report shows how a split-core, heat-pipe cooled reactor could conceptually eliminate these deterrents, and examines and summarizes recent work on split-core, heat-pipe reactors. A concept for a small reactor that could be developed at a comparatively low cost is presented. The concept would extend the technology of subcritical radioisotope thermoelectric generators using  $^{238}\text{PuO}_2$  to the evolution of critical space power reactors using  $^{239}\text{PuO}_2$ . Author

N74-20406 Motoren- und Turbinen-Union Muenchen G.m.b.H. (West Germany).

# **INVESTIGATION OF THE RELATIVE MERITS OF DIFFERENT POWER PLANTS FOR STOL-AIRCRAFT WITH BLOWN FLAP APPLICATION**

H. Grieb, W. Klusmann, and G. Weist In AGARD V/STOL Propulsion Systems Jan. 1974 19 p refs

The relative merits of different air supply systems for STOL-aircraft with blown flap application are investigated. Under consideration are self-sustained supply units, such as gas turbine driven compressors, remote compressors driven with hot gas from the cruise engines and 2 possibilities for off-take of compressed air from the cruise engines. The air supply systems reviewed are compared with respect to the design requirements, the operating behaviour including any reactions on the cruise

engines, the sensitivity to component failure and the weight penalty to be expected. Author

**N74-20408** Fiat S.p.A., Turin (Italy). Div. Aviazione.  
**ENGINE CYCLE SELECTION FOR COMMERCIAL STOL AIRCRAFT**

Giorgio Fao and Alfredo Capuani (Societa Aeritalia, Turin) /n AGARD V/STOL Propulsion Systems Jan. 1974 11 p

The cycle and design parameters pertinent to a turbofan to be used for STOL short haul applications have been studied. For the chosen aircraft configuration, the criteria that condition the choice of the cycle, listed in decreasing importance, have been determined as follows: (1) low noise level, (2) high specific thrust to obtain low-weight and reduced-size engines, and (3) low specific fuel consumption (s.f.c.). It is concluded that the controlling factor is the noise level requirement for airports in congested areas. In order to satisfy this and the mission operational requirements the turbofan engine is driven towards medium bypass ratios and high thrust weight ratios but with less emphasis on s.f.c. Author

**N74-20444** European Space Research Organization, Paris (France).  
**THE INFLUENCE OF INDIVIDUAL COMPONENTS AND OF THEIR MECHANICAL ARRANGEMENT ON THE STATIONARY OPERATING BEHAVIOUR OF DUAL CYCLE PROPULSION ENGINES**

Hubert Grieb. /n its Behaviour of the Turbine Engine Feb. 1974 p 4-45 Transl. into ENGLISH from "Verhalten des Turbotriebwerks", DGLR, Cologne, report DLR-Mitt-73-05, Jan. 1973 p 7-50

The influence of combustion chambers, compressors and afterburners, and their mechanical configuration, on the static performance of two-cycle turbojet engines with a high bypass ratio, was investigated. As a basis for comparison of the thermodynamic cycling processes, maximal thrust with and without afterburning at sea altitude and a flight Mach number of 0.9 were chosen. The following conclusions were drawn with regard to the type of engine investigated: (1) within certain limits, a desired performance can be obtained with several thermodynamic designs; (2) the influence of the mechanical configuration of the static performance is small; (3) the technological state-of-the-art of the components is essential for the quality of stationary operating characteristics; (4) the optimal turning of the compressor characteristics to the expected load lines has considerable influence on the operation; (5) the design of low pressure compressor transition to medium pressure compressor and (6) bypass channel needs special attention besides mechanical conception. ESRO

**N74-20453#** Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

**PROBLEM OF THE APPLICATION OF TURBOFAN ENGINES IN AIR TRANSPORT. METHODS OF INCREASE IN EFFICIENCY OF TURBOFAN ENGINE WITH HIGH BYPASS RATIOS**

A. L. Klyachkina 28 Nov. 1973 158 p refs Transl. into ENGLISH from Tr. Rzhskii Inst. inzh. Gradzhanskoi Aviatcii (USSR), no. 174, 1971 p 1-153

(AD-773292: FTD-MT-24-661-73) Avail: NTIS CSCL 21/5

The report contains Soviet generated articles relative to the operating parameters of gas turbine engines, thermodynamic functions, gas dynamics, and acoustic characteristics. GRA

**N74-20591#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

**JET ENGINE EXHAUST EMISSIONS OF HIGH ALTITUDE COMMERCIAL AIRCRAFT PROJECTED TO 1990**

Jack Grobman and Robert D. Ingebo Washington Mar. 1974 86 p refs

(NASA-TM-X-3007: E-7822) Avail: NTIS HC \$4.00 CSCL 21B

Projected minimum levels of engine exhaust emissions that may be practicably achievable for future commercial aircraft operating at high-altitude cruise conditions are presented. The

forecasts are based on: (1) current knowledge of emission characteristics of combustors and augmentors; (2) the status of combustion research in emission reduction technology; and (3) predictable trends in combustion systems and operating conditions as required for projected engine designs that are candidates for advanced subsonic or supersonic commercial aircraft fueled by either JP fuel, liquefied natural gas, or hydrogen. Results are presented for cruise conditions in terms of both an emission index (g constituent/kg fuel) and an emission rate (g constituent/hr). Author

**N74-20613#** Office of the White House Press Secretary, Washington, D.C.

**[NATIONAL ENERGY POLICY FOR MEETING US ENERGY REQUIREMENTS]**

Richard Nixon 18 Apr. 1973 19 p  
Avail: NTIS HC \$4.00

The President's energy policy proposals to Congress on April 18, 1973 are presented. Recommendations were made for the increased production of energy as well as more judicious use of energy resources. The following specific actions were proposed: (1) increased production and use of natural gas; (2) utilization of the oil and gas resources of the Outer Continental Shelf; (3) construction of the Alaska pipeline; (4) development of shale oil; (5) increased utilization of geothermal resources; (6) expanded development and utilization of coal resources; (7) rapid development of nuclear power plants; and (8) exploration of domestic mineral resources. The development of deepwater ports for facilitating imports was also recommended. The establishment of the Federal Energy Organization was outlined. S.K.W.

**N74-20614#** New York State Office of Economic Research, Albany.

**CONSUMPTION OF ENERGY IN NEW YORK STATE: 1972 (WITH ESTIMATES FOR 1973)**

Olaf Hausgaard Jan. 1974 32 p refs Supplement to QER-10 Supersedes QER-15

(QER-19; QER-10-Suppl; AER-15) Avail: NTIS HC \$4.75

Revisions in the 1971 consumption data for fossil fuels reveal that energy consumption in New York State in 1971 was 4,239.3 T-BTU, a drop of 53.6 T-BTU from 1970 (-1.2%). The decline was a result of an unprecedented drop in fossil fuel demand by the industrial section from 577.6 T-BTU in 1970 to 455.4 T-BTU in 1971. In 1972 the industrial sector consumed 414.8 T-BTU from fossil fuels, a decline of 8.9% from the 1971 level. During both 1971 and 1972 the other three major energy consuming sectors continued their upward trend in energy consumption. Author

**N74-20616#** Interior Dept., Washington, D.C.

**FINAL ENVIRONMENTAL STATEMENT FOR THE GEOTHERMAL LEASING PROGRAM. VOLUME 1: PROMULGATION OF LEASING AND OPERATING REGULATIONS**

1973 485 p refs 4 Vol.  
Avail: SOD HC \$4.20

Public lands potentially available for geothermal leasing are described. These include principally: (1) public, withdrawn, and acquired lands administered by the Secretary of the Interior; (2) national forests and other lands administered by the Forest Service, Department of Agriculture; and (3) lands containing a reservation to the United States of the geothermal resources. These lands total 638 million acres. The most promising geothermal resource areas are located predominantly in the 11 western States and Alaska. Included in this proposed action are: (1) the promulgation of leasing and operating regulations pursuant to which the program would be administered; and (2) the leasing of federally owned geothermal resources for development in three specific areas: (a) Clear Lake-Geysers; (b) Mono Lake-Long Valley; and (c) Imperial Valley, all in California. Author

**N74-20617#** Arkansas Univ., Fayetteville. Dept. of Physics.  
**ENERGY IN THE NEAR TERM**

Otto Henry Zinke 21 Jun. 1973 57 p refs Sponsored by Dept. of Commerce and Ford Found.  
Avail: NTIS HC \$6.00

The dependence of the United States on petroleum as a primary energy source is discussed. Data are presented which outline energy consumption and production estimates. Techniques which would reduce energy consumption are outlined. Correlations are made between energy consumption and employment.

S.K.W.

**N74-20819#** Bureau of Mines, Bartlesville, Okla. Energy Research Center.

**ENERGY PROGRAM, 1972**

Bill Linville and John D. Spencer 1973 115 p refs (BM-IC-8612) Avail: NTIS HC \$8.75

Major areas of research by the Bureau of Mines in 1972 for the development of new and improved efficient methods of conservation and utilization for petroleum and natural gas, oil shale, and coal are described. The major objective of the energy research program was to develop the technology for the wise development and use of the nation's energy resources as clean fuels at a reasonable and competitive cost. Emphasis was placed on studies of methods of stimulating production from oil and gas reservoirs. Studies of the fracturing systems of reservoir rocks and oil recovery by water or gas flooding are included.

Author

**N74-20821#** RAND Corp., Santa Monica, Calif.  
**ENERGY ALTERNATIVES FOR CALIFORNIA: THE CURRENT CRISIS. 1: THE IMPACT OF ARAB OIL EXPORT POLICIES ON THE CALIFORNIA ENERGY SYSTEM**

William R. Ahern Dec. 1973 22 p refs (P-6146) Avail: NTIS HC \$4.25

The objectives of this presentation are: (1) to indicate the impacts of the Arab embargo of oil shipments to the United States on the California energy system; (2) to show how these impacts interrelate with the major trends in state energy supplies and uses; and (3) to identify and measure the important energy shortage allocation problems facing Federal and State officials.

Author

**N74-20822#** RAND Corp., Santa Monica, Calif.  
**COPING WITH THE FUEL SHORTAGE: A GUIDE FOR LOS ANGELES RESIDENTS**

M. H. Graubard and J. J. Mutch Jan. 1974 23 p (P-5154) Avail: NTIS HC \$4.25

Energy uses and conservation measures for the Los Angeles, California area are outlined. Charts are presented which show: the consumption rates for different household appliances; the sources of energy, and consumption of energy by automobiles. Measures for voluntary energy conservation among residents are outlined along with an emergency plan for electric utilities.

S.K.W.

**N74-20826#** Kernforschungsanlage, Juelich (West Germany). Inst. fuer Reaktorentwicklung.  
**APPROACH TO THE HOLISTIC ANALYSIS OF THE SYSTEM MAN-ENERGY-ENVIRONMENT**

A. Voss Jul. 1973 193 p refs In GERMAN; ENGLISH summary (JUL-982-RG) Avail: AEC Depository Libraries HC \$11.75

A holistic analysis for the system man-energy-environment regarding economical, ecological, and technical aspects is presented. The aim is to comprehend all significant influence factors and interactions as well as to compare and to evaluate the positive and negative effects of an increasing energy consumption and its protection by alternative energy supply systems. For such complex systems new methods developed in the field of system engineering, especially cybernetic simulation, have to be used for the derivation of adequate aid for decision.

NSA

**N74-20827#** Oak Ridge National Lab., Tenn.  
**ENERGY RESEARCH AND DEVELOPMENT: A SELECTED READING LIST**

M. P. Guthrie, ed., E. E. Huber, ed., and G. A. Norwood, ed. Nov. 1973 237 p Sponsored by NSF (Contract W-7405-eng-28) (ORNL-EIS-73-85) Avail: NTIS HC \$14.00

A selected listing of 1,219 publications is assembled for the identification of promising areas for energy research and development. The document is designed to assist the layman. The genesis of the reading list was a need to gain a perspective on what has already been done in energy research and development. The perspective was required to support the development of a report to the President from the Chairman of the AEC on long-range energy research and development needs and policy as requested in the President's June 29, 1973 statement on Energy and National Resources. The bibliography emphasizes general publications on energy sources, electric power, generation, energy uses, and references on energy supply and demand studies. An appendix includes an author index, a simple title index, and a permuted index on titles. NSA

**N74-20847** Escher Technology Associates, St. Johns, Mich.  
**PROSPECTS FOR LIQUID HYDROGEN FUELED COMMERCIAL AIRCRAFT**

William J. D. Escher Sep. 1973 39 p refs (PR-37) Copyright. Avail: Issuing Activity

The use of hydrogen as a fuel for aircraft propulsion is discussed. The benefits of hydrogen with respect to air pollution reduction are analyzed. Liquid hydrogen as a potential future aviation fuel is considered to be the only practical chemical fuel producible from ultimate nonfossil energy primary sources. The aerodynamic configurations and aircraft systems involved in hydrogen propulsion are described and illustrated. The facilities and processes for commercial production of hydrogen are reported.

Author

**N74-20854#** National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.  
**AERONAUTICAL FUEL CONSERVATION POSSIBILITIES FOR ADVANCED SUBSONIC TRANSPORTS**

Albert L. Braslow and Allen H. Whitehead, Jr. 20 Dec. 1973 15 p (NASA-TM-X-71927) Avail: NTIS HC \$4.00 CSCL 01C

The anticipated growth of air transportation is in danger of being constrained by increased prices and insecure sources of petroleum-based fuel. Fuel-conservation possibilities attainable through the application of advances in aeronautical technology to aircraft design are identified with the intent of stimulating NASA R and T and systems-study activities in the various disciplinary areas. The material includes drag reduction; weight reduction; increased efficiency of main and auxiliary power systems; unconventional air transport of cargo; and operational changes.

Author

**N74-20887** Kansas State Univ., Manhattan.  
**OPTIMAL ELECTRICAL ENERGY GROWTH STRATEGIES IN AN ERA OF ENVIRONMENTAL CONCERN** Ph.D. Thesis

Jerry William Stauder 1973 151 p Avail: Univ. Microfilms Order No. 74-6661

A linear programming model of the United States' expanding electrical energy economy is presented. The model finds the minimum cost compromise among the three problems of rapid growth of electrical energy demand, a marginal fuel supply, and environmental protection. It was assumed that the electrical energy demand would be met primarily with nuclear and coal fueled power plants. Linear programming was selected as the optimizing tool. The objective was to minimize the total cost of generating the electrical energy demand in the time period of 1970 to 2000. The costs considered are capital, fuel, operating and maintenance, storage costs of certain fuels, and costs associated with environmental protection.

Dissert. Abstr.

**N74-20899#** Stanford Research Inst., Menlo Park, Calif.  
**PATTERNS OF ENERGY CONSUMPTION IN THE UNITED STATES**

Jan. 1972 236 p refs Sponsored by Office of Sci. and Technol. Avail: SOD HC \$2.25

The objectives of the study are to determine: (1) what significant purposes have fuels been used for in the United States; (2) what portion of the nation's energy requirements for the



various end uses have been met by each fuel; (3) what has been the rate of growth of consumption in the major end uses of each fuel; (4) what technical efficiency can be expected when each fuel is used for those end uses for which it is suitable; The emphasis of the study was on the residential, commercial, and industrial sectors, the use of electric power has also been incorporated, along with the transportation sector, in order to arrive at a total energy balance. This report is strictly a factual document; its purpose is to provide the most detailed information practicable on how the nation uses its energy. Author

**N74-20700#** Kanner (Leo) Associates, Redwood City, Calif.  
**SUPPLEMENT TO THE REPORT ON THE RESULTS  
ACHIEVED WITH SEAS' EXPERIMENTAL MILL**

J. Juul Washington NASA Apr. 1974 40 p refs Transl. into ENGLISH from Elektroteknikeren (Copenhagen), v. 48, Feb. 1952 p 65-79

(Contract NASw-2481)

(NASA-TT-F-15518) Avail: NTIS HC \$5.00 CSCL 10A

Results achieved with an experimental windmill are elaborated on: greatest efficiency of the mill was obtained at a wingtip velocity of 38 m/x; effects caused by wind pressure should not exceed 800 kg/sq cm in any part of the wing or tower, and effects caused by gravity in the wings should not exceed 200-300 kg/sq cm. Experience has shown that the optimal height of the support tower should be from 18-24 m. A history of the Dutch windmill's use and its construction, and also of various modern experimental wind power stations in various parts of the world is given. Costs of building wind power stations are discussed.

Author

**N74-20701#** Techtran Corp., Glen Burnie, Md.  
**LINE OF DEVELOPMENT OF RURAL WIND POWER  
PLANTS**

K. I. Shanfer and A. A. Ivanov Washington NASA May 1974 7 p refs Transl. into ENGLISH from Elektrichestvo (USSR), no. 5, May 1941 p 21-22

(Contract NASw-2485)

(NASA-TT-F-15513) Avail: NTIS HC \$4.00 CSCL 10A

The use of wind power plants for rural electrification is discussed. The application of various alternative power supply systems involving wind power plants is examined, and the advantages and disadvantages of each alternative are presented.

Author

**N74-20702#** Stuttgart Univ. (West Germany). Inst. fuer  
Plasmaforschung.

**GENERAL ENERGY CONVERSION AND THE ENERGY  
MINIMUM PRINCIPLE [ALLGEMEINE ENERGIEWAND-  
LUNG UND DAS ENERGIE-MINIMUMPRINZIP]**

H. K. Messerle 1973 28 p refs In GERMAN

(IPF-73-4) Avail: NTIS HC \$4.50

The internal or stored energy of an open system was used as a basis for the description of a general energy conversion theory. The properties of the energy function as a state function were determined by 4 postulates of which 3 were basic and intuitive. This results in defining the entropy as an intensive quantity with a reversible property. The energy losses which lead to entropy increase in the interior should be treated independently. So-called inverse processes can be treated as equalization of flow conditions. The result is a dynamic system representation in which the methodology of system theory is used.

ESRO

**N74-20703#** Air Force Systems Command, Wright-Patterson  
AFB, Ohio. Foreign Technology Div.

**STATE-OF-THE-ART AND PROSPECTS OF MAGNETOELEC-  
TRIC MACHINES FOR SELF-CONTAINED ELECTRICAL  
SUPPLY SYSTEMS AND CONTROLLABLE ELECTRICAL  
DRIVERS**

V. A. Balagurov and N. T. Koroban 14 Jan. 1974 20 p refs Transl. into ENGLISH from Tr. Energ. Inst. (Moscow), no. 139, 1972 p 6-18

(AD-773893; FTD-HT-23-26-74) Avail: NTIS CSCL 10/2

The characteristics and applications of magnetoelectric machines are discussed. The development of improved permanent

magnets for use with magnetoelectric machines has made it possible to broaden the field of application of the machines with respect to power and frequency. The specific characteristics of the permanent magnets for various applications are defined. It is stated that the selection of one type of magnet system and magnetoelectric generator design over another is usually determined by the magnetic and technological properties of the alloys and the purpose, power, speed, and frequency of the generator. Author

**N74-20704#** Air Force Systems Command, Wright-Patterson  
AFB, Ohio. Foreign Technology Div.

**DEPENDENCE OF EFFICIENCY AND SPECIFIC CHARAC-  
TERISTICS OF FUEL CELLS ON DISCHARGE CONDI-  
TIONS**

V. S. Daniel-Bek 8 Jan. 1974 17 p refs Transl. into ENGLISH from Sb. Rab. Khim. IstochNIKam Toka (Leningrad), no. 2, 1967 p 155-163

(AD-773264; FTD-HT-23-8-74) Avail: NTIS CSCL 10/2

An analysis is given of the dependence of efficiency, specific power, and specific energy of a fuel cell on the discharge conditions. General principles for selecting optimum conditions are examined. GRA

**N74-20705#** Defense Documentation Center, Alexandria, Va.  
**ENERGY SOURCES - CITATIONS FROM THE EARLY DDC  
COLLECTIONS Report Bibliography, Mar. 1933 - Jun. 1952**

Jan. 1974 26 p refs

(AD-773326; DDC-TAS-74-10) Avail: NTIS CSCL 21/4

This bibliography consists of 121 citations on Energy Sources dated March 1933 to June 1952. These are not in the collection of the DDC Automated Data Banks. They are arranged by ATI (Air Technical Index) numbers, and are available via regular DDC document request procedures. GRA

**N74-20709#** Applied Physics Lab., Johns Hopkins Univ., Silver  
Spring, Md.

**DESIGN CONSIDERATIONS FOR A 100-MEGAJOULE/500-  
MEGAWATT SUPERFLYWHEEL**

David W. Rabenhorst and Robert J. Taylor Dec. 1973 87 p refs

(Contract N00017-72-C-4401)

(AD-774738; APL-TG-1229) Avail: NTIS CSCL 10/1

The magnitude of stored energy required in high power bursts for modern experiments in physics has reached the point where capacitor banks previously used for this purpose are no longer practical. Although flywheels have been proven to be less expensive for this purpose and are one-hundredth the size, even the practicality of future flywheel-powered systems is being challenged by the magnitude of future experiment energy requirements. An existing steel flywheel capable of delivering 100 MJ at a rate of 100 MW costs \$1,500,000 and weighs 60,000 pounds. Future experiments may require 20 times this energy. The report describes a Superflywheel having a design goal of delivering 100 MJ at a rate of 500 MW. Its projected cost is less than \$50,000. Also, it appears to be readily scalable to the larger size required for future experiments. Author (GRA)

**N74-20710#** Pratt and Whitney Aircraft, East Hartford, Conn.  
**THE 1.5-KW FUEL CELL POWERPLANT CATALYST IN-  
VESTIGATION Supplement to Final Report, 1 Oct. 1972 -  
30 Jun. 1973**

Donald R. McVay Jul. 1973 29 p

(Contract DAAK02-70-C-0518; DA Proj. 1G6-63702-DG-10) (AD-774274; PWA-4704A-Suppl) Avail: NTIS CSCL 10/2

The objective of this program was to improve the PC14 powerplant thermal cracker catalyst and to define its performance characteristics. Five areas were investigated: (1) the type of catalyst ceramic support and the level of nickel loading, (2) the effect of shock and vibration on performance, (3) performance on leaded gasoline and JP-4, (4) the effect of high sulfur fuel on performance, and (5) endurance on leaded gasoline. The results of the study are given in the report. GRA

N74-20948\*# Texas Instruments, Inc., Dallas.

**ERTS-1 IMAGERY USE IN RECONNAISSANCE PROSPECTING: EVALUATION OF COMMERCIAL UTILITY OF ERTS-1 IMAGERY IN STRUCTURAL RECONNAISSANCE FOR MINERALS AND PETROLEUM Final Report, 20 Aug. 1972 - 23 Oct. 1973**

D. F. Saunders, G. E. Thomas, Principal Investigators, F. E. Kinsman, and D. F. Beatty Dec. 1973 162 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS

(Contract NAS5-21796)

(E74-10345; NASA-CR-136857; U1-702700-F) Avail: NTIS HC \$11.25 CSCL 08G

The author has identified the following significant results. This study was performed to investigate applications of ERTS-1 imagery in commercial reconnaissance for mineral and hydrocarbon resources. ERTS-1 imagery collected over five areas in North America (Montana; Colorado; New Mexico-West Texas; Superior Province, Canada; and North Slope, Alaska) has been analyzed for data content including linears, lineaments, and curvilinear anomalies. Locations of these features were mapped and compared with known locations of mineral and hydrocarbon accumulations. Results were analyzed in the context of a simple-shear, block-coupling model. Data analyses have resulted in detection of new lineaments, some of which may be continental in extent, detection of many curvilinear patterns not generally seen on aerial photos, strong evidence of continental regmatic fracture patterns, and realization that geological features can be explained in terms of a simple-shear, block-coupling model. The conclusions are that ERTS-1 imagery is of great value in photogeologic/geomorphic interpretations of regional features, and the simple-shear, block-coupling model provides a means of relating data from ERTS imagery to structures that have controlled emplacement of ore deposits and hydrocarbon accumulations, thus providing a basis for a new approach for reconnaissance for mineral, uranium, gas, and oil deposits and structures.

**N74-21391# Esso Research and Engineering Co., Linden, N.J. COMBUSTION AND HEAT RECOVERY OF AIR FORCE WASTE PETROLEUM OILS AND LUBRICANTS Final Report, Aug. - Dec. 1973**

Martin Lieberman Feb. 1974 73 p refs

(Contract F29601-73-C-0101; AF Proj. 683M)

(AD-774563; AFWL-TR-73-244) Avail: NTIS CSCL 21/4

The primary objective of this study was to evaluate the technical feasibility of disposing of waste oils and contaminated fuels generated at Air Force bases by burning them with fuel oil and/or natural gas in a conventional boiler installation. Waste aviation piston-engine oil, synthetic turbine lubricant, hydraulic fluid, Stoddard solvent, crankcase oil, JP-4 jet fuel, and aviation gasoline were burned in No. 2, No. 6 fuel oils, and with natural gas carriers. The results of combustion tests, conducted for as long as 3 hours, indicated that the waste oils could be burned at as high as 5 percent by volume in the fuel oils without producing any significant air pollution or boiler corrosion problems. Each gallon of waste oil or contaminated fuel burned saves approximately a gallon of fuel oil. GRA

**N74-21605# Committee on Aeronautical and Space Sciences (U. S. Senate).****NASA AUTHORIZATION FOR FISCAL YEAR 1975, PART 1**

Washington GPO 1974 538 p refs Hearings on S. 2955 before Comm. on Aeron. and Space Sci., 93d Congr., 2d Sess., 5, 26 and Feb. 1974

Avail: Comm. on Aeron. and Space Sci.

The Congressional hearings on the NASA authorization for Fiscal Year 1975 are presented. The hearings concern appropriation of funds for research and development, construction of facilities, and program management. The projects discussed include: (1) aircraft noise abatement research, (2) civil and military short haul aircraft, (3) civil and military long haul aircraft, (4) highly maneuverable aircraft technology, (5) aeronautics fuel conservation, (6) exploration of space, and (7) energy technology for civilian needs. P.N.F.

N74-21619# Mitre Corp., McLean, Va.

**BACKGROUND MATERIAL FOR THE ENERGY POLICY WORKSHOP, 11-12 JANUARY 1973**

Richard S. Greeley Feb. 1973 79 p

(M73-12) Avail: NTIS HC \$7.00

A specific set of energy policies focused on achieving competitive fuel prices, increased domestic fuel supplies, and environmental protection is discussed. A set of charts containing background information on current and projected fuels availabilities and prices and a narrative discussion of each one is presented.

Author

**N74-21620# Committee on Interior and Insular Affairs (U. S. Senate).****CONSERVATION OF ENERGY**

Washington GPO 1972 121 p refs Presented to Comm. on Interior and Insular Affairs, 92d Congr., 2d Sess., 1 Aug. 1972 Prepared by Library of Congr.

Avail: SOD HC \$0.50

The following topics relating to the conservation of energy resources are discussed. (1) The dependence of the United States on foreign supplies of oil and gas, and the extent to which energy conservation can provide greater national security through the reduction of imports. (2) The economic and technical feasibility of extending the use of available fuel reserves over a longer period of time through more efficient use of production and controls. (3) The consequences of a comprehensive federal program for energy conservation, considering the fact that existing policy is based on the premise that federal and state regulations should encourage industry to meet whatever demands are created in the marketplace. (4) The extent to which advances in finding new energy sources, i.e., solar, breeder, or controlled thermonuclear, will lessen the need for energy conservation. Author

**N74-21624# Joint Economic Committee (U. S. Congress).****THE GASOLINE AND FUEL OIL SHORTAGE From the Subcommittee on Consumer Economics**

Washington GPO 1973 295 p refs Hearings before Joint Econ. Comm., 93d Congr., 1st Sess., 1-2 May and 2 Jun. 1973

(GPO-99-740) Avail: SOD HC \$2.00

A Congressional hearing on the gasoline and fuel oil shortage is presented. The impact of the shortages on the overall economy of the nation is analyzed. The outlook for the fuel situation in the period 1972 through 1975 is examined. Methods for correcting the fuel shortage are proposed. The government policy with respect to resources management and fuel allocations is discussed. The economic condition and operating problems of various gasoline and oil companies are reported by selected representatives from these companies. P.N.F.

**N74-21625# Committee on Interstate and Foreign Commerce (U. S. House).****TRANSPORTATION CONTROLS UNDER THE CLEAN AIR ACT**

Washington GPO Sep. 1973 64 p refs Presented to Comm. on Interstate and Foreign Com., 93d Congr., 1st Sess., Sep. 1973

(GPO-20-345) Avail: Subcomm. on Public Health and Environment

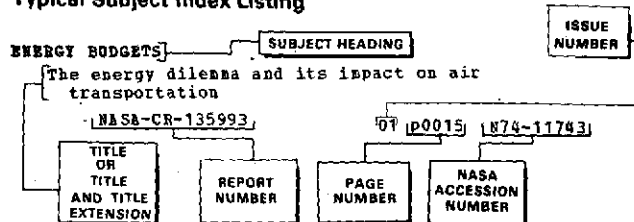
A Congressional investigation of the provisions of the Clean Air Act and the effects on various parts of the economy, especially the transportation aspects, was conducted. The subjects discussed are: (1) Environmental Protection Agency, (2) reaction to proposed transportation control strategies, (3) relationship between new car emission standards and transportation control requirements, and (4) energy implications of transportation controls. The majority of the information consists of testimony from selected persons with expertise in the environmental protection subjects. P.N.F.

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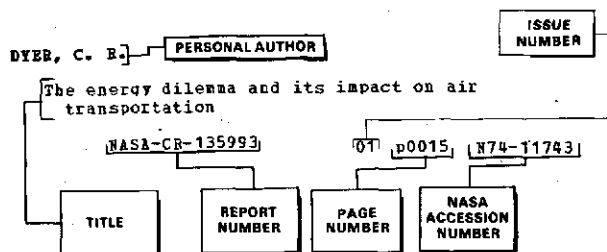
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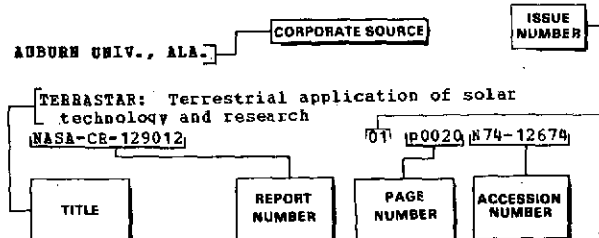


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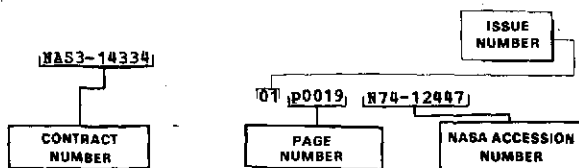
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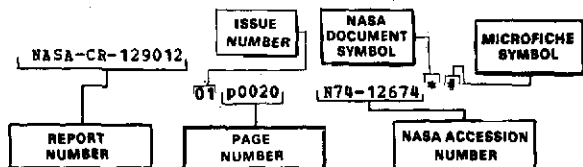
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